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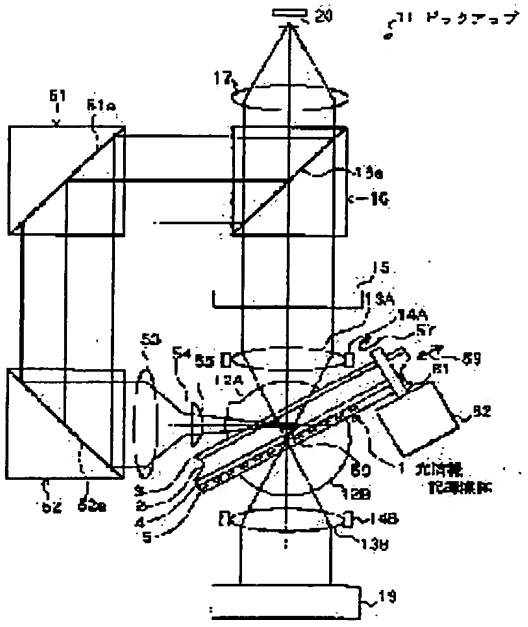
(54) DEVICE AND METHOD FOR OPTICAL INFORMATION RECORDING, AND DEVICE AND METHOD FOR OPTICAL INFORMATION REPRODUCING

(57)Abstract:
PROBLEM TO BE SOLVED: To record information in a higher density in an optical information recording medium for recording information by using a holography.
SOLUTION: During recording, a laser light emitted from a laser coupler 20 is separated by a beam splitter 16, one light is passed through a space light modulator 15 to become an information light, and this information light is converged by an objective lens 13A, passed through a solid emersion lens 12A and projected to an optical information recording medium 1. The other light obtained as a result of the separation by the beam splitter 16 is passed through prisms 51 and 52, a convex lens 53, a concave lens 54 and a cylindrical lens 55 to become a recording reference light having a flat shape, passed through the solid emersion lens 12A and then projected to the optical information recording medium 1. The information light and the recording reference light intersect each other in an information recording layer 2, and in the information recording layer 2, a recording area composed of a volume hologram is formed in a layer shape.



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CLAIMS

[Claim(s)]
[Claim 1] It is an optical information recording device for recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information. So that an optical generation means for record to generate the information light and the reference beam for record which supported information, and the record section where information is recorded in said information recording layer with the interference pattern by interference with information light and the reference beam for record may be formed in the shape of a layer The optical information recording device which makes a flat configuration one flux of light of information light and the reference beams for record, and is characterized by having the record optical system for irradiating information light and the reference beam for record to an information recording layer so that it may cross within an information recording layer.
[Claim 2] The optical information recording device according to claim 1 characterized by having a position control means to control the location of the information light to said optical information record medium, and the reference beam for record.
[Claim 3] Said position control means is an optical information recording device according to claim 2 characterized by controlling the location of the information light to an optical information record medium, and the reference beam for record using the information recorded on said positioning field using the thing equipped with the positioning field where the information for positioning of information light and the reference beam for record is recorded as said optical information record medium.
[Claim 4] Said position control means is an optical information recording device according to claim 2 characterized by controlling the location of the information light to an optical information record medium, and the reference beam for record so that two or more record sections may be formed without lapping mutually in an information recording layer.
[Claim 5] Said record optical system is an optical information recording device according to claim 1 characterized by irradiating information light and the reference beam for record to an information recording layer so that each core may intersect perpendicularly mutually.
[Claim 6] Said record optical system is an optical information recording device according to claim 1 characterized by having the solid emersion lens which it is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass.
[Claim 7] It is an optical information recording device for recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information. So that the interference pattern by interference with information light and the reference beam for record may be formed an optical generation means for record to generate the information light and the reference beam for record which supported information, and in said information recording layer So that the record section where information was recorded with said interference pattern, and it was fixed to information may be formed in the shape of a layer the Mitsuteru gunner stage for record for irradiating information light and the reference beam for record to an information recording layer, and in said information

recording layer As opposed to the field where said interference pattern was formed in the information recording layer The optical information recording device characterized by having the Mitsuteru gunner stage for fixing for irradiating so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established.
[Claim 8] The optical information recording device according to claim 7 characterized by having a position control means to control the location of the information light to said optical information record medium, and the reference beam for record.
[Claim 9] Said position control means is an optical information recording device according to claim 8 characterized by controlling the location of the information light to an optical information record medium, and the reference beam for record using the information recorded on said positioning field using the thing equipped with the positioning field where the information for positioning of information light and the reference beam for record is recorded as said optical information record medium.
[Claim 10] Said position control means is an optical information recording device according to claim 8 characterized by controlling the location of the information light to an optical information record medium, and the reference beam for record so that two or more record sections may be formed without lapping mutually in an information recording layer.
[Claim 11] Said record optical system is an optical information recording device according to claim 7 characterized by having the solid emersion lens which it is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass.
[Claim 12] It is the optical information record approach for recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information. By generating the information light and the reference beam for record which supported information, making one flux of light of information light and the reference beams for record into a flat configuration, and irradiating information light and the reference beam for record to an information recording layer so that it may cross within an information recording layer The optical information record approach characterized by forming the record section where information is recorded in an information recording layer with the interference pattern by interference with information light and the reference beam for record in the shape of a layer.
[Claim 13] It is the optical information record approach for recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information. So that the information light and the reference beam for record which supported information may be generated and the interference pattern by interference with information light and the reference beam for record may be formed in said information recording layer As opposed to the field where information light and the reference beam for record were irradiated to the information recording layer, and said interference pattern was formed in the information recording layer By irradiating so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established The optical information record approach characterized by forming the record section where information was recorded with the interference pattern in the information recording layer, and it was fixed to information in the shape of a layer.
[Claim 14] While recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information An optical generation means for record to generate the information light and the reference beam for record which are an optical information record regenerative apparatus for reproducing information, and supported information from the optical information record medium, So that the record section where information is recorded with the interference pattern by interference with information light and the reference beam for record may be formed in the shape of a layer in said information recording layer The record optical system for irradiating information light and the

reference beam for record to an information recording layer so that one flux of light of information light and the reference beams for record may be made into a flat configuration and it may cross within an information recording layer, To an information recording layer, while irradiating the reference beam for playback corresponding to the reference beam for record at the time of record The optical information record regenerative apparatus characterized by having a detection means to detect the playback light collected according to the playback optical system and this playback optical system for collecting the playback light generated from an information recording layer by irradiating the reference beam for playback.

[Claim 15] The optical information record regenerative apparatus according to claim 14 characterized by having a position control means to control the location of the information light to said optical information record medium, the reference beam for record, and the reference beam for playback.

[Claim 16] Said position control means is the optical information record regenerative apparatus according to claim 15 characterized by to control the location of the information light to an optical information record medium, the reference beam for record, and the reference beam for playback using the information recorded on said positioning field using the thing equipped with the positioning field where the information for positioning of information light, the reference beam for record, and the reference beam for playback is recorded as said optical information record medium.

[Claim 17] It is the optical information record regenerative apparatus according to claim 14 which has the solid emersion lens which said record optical system is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass, and is characterized by having the solid emersion lens which said playback optical system is arranged so that an optical information record medium may be countered, and playback light passes.

[Claim 18] While recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information An optical generation means for record to generate the information light and the reference beam for record which are an optical information record regenerative apparatus for reproducing information, and supported information from the optical information record medium, So that the interference pattern by interference with information light and the reference beam for record may be formed in said information recording layer So that the record section where information was recorded with said interference pattern, and it was fixed to information may be formed in the shape of a layer the Mitsuteru gunner stage for record for irradiating information light and the reference beam for record to an information recording layer, and in said information recording layer As opposed to the field where said interference pattern was formed in the information recording layer The Mitsuteru gunner stage for fixing for irradiating so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established, To an information recording layer, while irradiating the reference beam for playback corresponding to the reference beam for record at the time of record The optical information record regenerative apparatus characterized by having a detection means to detect the playback light collected according to the playback optical system and this playback optical system for collecting the playback light generated from an information recording layer by irradiating the reference beam for playback.

[Claim 19] The optical information record regenerative apparatus according to claim 18 characterized by having a position control means to control the location of the information light to said optical information record medium, the reference beam for record, and the reference beam for playback.

[Claim 20] Said position control means is the optical information record regenerative apparatus according to claim 19 characterized by to control the location of the information light to an optical information record medium, the reference beam for record, and the reference beam for playback using the information recorded on said positioning field using the thing equipped with the positioning field where the information for positioning of information light, the reference beam for record, and the reference beam for playback is recorded as said optical information record medium.

[Claim 21] It is the optical information record regenerative apparatus according to claim 18 which

has the solid emersion lens which said record optical system is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass, and is characterized by having the solid emersion lens which said playback optical system is arranged so that an optical information record medium may be countered, and playback light passes.

[Claim 22] While recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information It is the optical information record playback approach for reproducing information from an optical information record medium. At the time of informational record By generating the information light and the reference beam for record which supported information, making one flux of light of information light and the reference beams for record into a flat configuration, and irradiating information light and the reference beam for record to an information recording layer so that it may cross within an information recording layer The record section where information is recorded in an information recording layer with the interference pattern by interference with information light and the reference beam for record is formed in the shape of a layer. At the time of informational playback The optical information record playback approach which collects the playback light generated from an information recording layer by irradiating the reference beam for playback, and is characterized by detecting the collected playback light while irradiating the reference beam for playback corresponding to the reference beam for record at the time of record at an information recording layer.

[Claim 23] While recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography with the interference pattern by interference with the information light and the reference beam for record which supported information It is the optical information record playback approach for reproducing information from an optical information record medium. At the time of informational record So that the information light and the reference beam for record which supported information may be generated and the interference pattern by interference with information light and the reference beam for record may be formed in an information recording layer As opposed to the field where information light and the reference beam for record were irradiated to the information recording layer, and said interference pattern was formed in the information recording layer By irradiating so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established The record section where information was recorded with the interference pattern in the information recording layer, and it was fixed to information is formed in the shape of a layer. At the time of informational playback The optical information record playback approach which collects the playback light generated from an information recording layer by irradiating the reference beam for playback, and is characterized by detecting the collected playback light while irradiating the reference beam for playback corresponding to the reference beam for record at the time of record at an information recording layer.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical information record regenerative apparatus and approach of reproducing information from an optical information record medium while recording information to an optical information record medium using the optical information recording device which records information to an optical information record medium using holography, an approach, and holography.
[0002]
[Description of the Prior Art] Holographic record which records information on a record medium using holography is performed by writing the interference fringe which can generally do light with image information, and a reference beam superposition and then inside a record medium in a record medium. At the time of playback of the recorded information, image information is reproduced by irradiating a reference beam at the record medium by the diffraction by the interference fringe.
[0003] In recent years, for super-high density optical recording, volume holography, especially digital volume holography are developed in a practical use region, and attract attention. Volume holography is a method with which it utilizes positively and the thickness direction of a record medium also writes in an interference fringe in three dimension, diffraction efficiency is raised by increasing thickness and there is the description that increase of storage capacity can be aimed at using multiplex record. And with digital volume holography, although volume holography, the same record medium, and a recording method are used, the image information to record is the computer-oriented holographic recording method limited to the digital pattern made binary. In this digital volume holography, it once digitizes, and develops to two-dimensional digital pattern information, and image information like an analog--, for example picture also records this as image information. At the time of playback, it is reading and decoding this digital pattern information, and it is returned and displayed on the original image information. It becomes possible to reproduce the information on original very faithfully by performing differential detection, or coding binary-ized data and performing an error correction by this, at the time of playback, even if an SN ratio (S/N) is somewhat bad.
[0004] Drawing 26 is the perspective view showing the configuration of the outline of the record reversion system in the conventional digital volume holography. The space optical modulator 101 with which this record reversion system generates the information light 102 based on two-dimensional digital pattern information, The lens 103 which the information light 102 from this space optical modulator 101 is condensed, and is irradiated to the hologram record medium 100, A reference beam exposure means to irradiate a reference beam 104 from the direction which carries out an abbreviation rectangular cross with the information light 102 to the hologram record medium 100 (not shown), It has the lens 106 which condenses the playback light 105 by which outgoing radiation is carried out from the CCD (charge-coupled device) array 107 and the hologram record medium 100 for detecting the reproduced two-dimensional digital pattern information, and irradiates on the CCD array 107. the hologram record medium 100 -- LiNbO3 etc. -- a crystal is used.
[0005] In the record reversion system shown in drawing 26 , at the time of record, the information on the subject-copy image to record is digitized, the signal of 0 or 1 is further arranged to two-dimensional, and two-dimensional digital pattern information is generated. One two-dimensional

digital pattern information is called page data. Here, multiplex record of the page data of #1 - #n shall be carried out at the same hologram record medium 100. In this case, first, based on page data #1, by choosing transparency or protection from light for every pixel with the space optical modulator 101, the information light 102 modulated spatially is generated and the hologram record medium 100 is irradiated through a lens 103. A reference beam 104 is irradiated at the hologram record medium 100 from the direction theta 1 which carries out an abbreviation rectangular cross with the information light 102, and the interference fringe made by the superposition of the information light 102 and a reference beam 104 inside the hologram record medium 100 is recorded on coincidence. In addition, in order to raise diffraction efficiency, a reference beam 104 deforms into a flat beam by a cylindrical lens etc., and an interference fringe crosses even in the thickness direction of the hologram record medium 100, and is recorded. At the time of the following record of page data #2, a reference beam 104 is irradiated from a different include angle theta 2 from theta 1, and multiplex record of the information can be carried out to the same hologram record medium 100 by piling up this reference beam 104 and the information light 102. Similarly, at the time of record of other page data #3 - #n, a reference beam 104 is irradiated from include-angle theta3-thetan different, respectively, and multiplex record of the information is carried out. Thus, information calls a stack the hologram by which multiplex record was carried out. In the example shown in drawing 26 , the hologram record medium 100 has two or more stacks (a stack 1, a stack 2, --, Stack m, --).
[0006] What is necessary is just to irradiate the reference beam 104 of whenever [same incident angle / as the time of recording the page data] at the stack, in order to reproduce the page data of arbitration from a stack. If it does so, the reference beam 104 will be alternatively diffracted by the interference fringe corresponding to the page data, and the playback light 105 will generate it by it. Incidence of this playback light 105 is carried out to the CCD array 107 through a lens 106, and the two-dimensional pattern of playback light is detected by the CCD array 107. And the information on a subject-copy image etc. is reproduced by decoding the two-dimensional pattern of the detected playback light contrary to the time of record.
[0007]
[Problem(s) to be Solved by the Invention] However, in the conventional volume holography which was explained using drawing 26 , the record section (volume hologram) of one unit is formed in the part to which the information light 102 and a reference beam 104 lap in the hologram record medium 100 in the shape of a block. Therefore, the record section of one unit becomes comparatively large, and there is a trouble that high density record is difficult. In addition, although multiplex record of the information can be carried out by changing the include angle of a reference beam at the conventional volume holography which was explained using drawing 26 , since separation of each information becomes difficult so that the number of the information which carries out multiplex record is made [many], there is a limitation also in high density record-ization by multiplex record.
[0008] This invention was made in view of this trouble, and the purpose is in offering the optical information recording device, the approach, the optical information record regenerative apparatus, and approach which enabled it to record information on high density more to the optical information record medium with which information is recorded using holography.
[0009]
[Means for Solving the Problem] An optical generation means for record to generate the information light and the reference beam for record with which the optical information recording device according to claim 1 supported information, So that the record section where information is recorded with the interference pattern by interference with information light and the reference beam for record may be formed in the shape of a layer in an information recording layer One flux of light of information light and the reference beams for record is made into a flat configuration, and it has the record optical system for irradiating information light and the reference beam for record to an information recording layer so that it may cross within an information recording layer.
[0010] An optical information recording device according to claim 7 so that the interference pattern by interference with information light and the reference beam for record may be formed an optical generation means for record to generate the information light and the reference beam for record which supported information, and in an information recording layer So that the record section where information was recorded with the interference pattern, and it was fixed to information may be

formed in the shape of a layer the Mitsuteru gunner stage for record for irradiating information light and the reference beam for record to an information recording layer, and in an information recording layer It has the Mitsuteru gunner stage for fixing for irradiating so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established to the field where the interference pattern was formed in the information recording layer.

[0011] The optical information record approach according to claim 12 generates the information light and the reference beam for record which supported information. By making one flux of light of information light and the reference beams for record into a flat configuration, and irradiating information light and the reference beam for record to an information recording layer so that it may cross within an information recording layer The record section where information is recorded in an information recording layer with the interference pattern by interference with information light and the reference beam for record is formed in the shape of a layer.

[0012] So that the optical information record approach according to claim 13 may generate the information light and the reference beam for record which supported information and the interference pattern by interference with information light and the reference beam for record may be formed in an information recording layer As opposed to the field where information light and the reference beam for record were irradiated to the information recording layer, and the interference pattern was formed in the information recording layer By irradiating so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established the record section where information was recorded with the interference pattern in the information recording layer, and it was fixed to information is formed in the shape of a layer -- it is.

[0013] An optical generation means for record to generate the information light and the reference beam for record with which the optical information record regenerative apparatus according to claim 14 supported information, So that the record section where information is recorded with the interference pattern by interference with information light and the reference beam for record may be formed in the shape of a layer in an information recording layer The record optical system for irradiating information light and the reference beam for record to an information recording layer so that one flux of light of information light and the reference beams for record may be made into a flat configuration and it may cross within an information recording layer, To an information recording layer, while irradiating the reference beam for playback corresponding to the reference beam for record at the time of record It has a detection means to detect the playback light collected according to the playback optical system and this playback optical system for collecting the playback light generated from an information recording layer, by irradiating the reference beam for playback.

[0014] An optical information record regenerative apparatus according to claim 18 so that the interference pattern by interference with information light and the reference beam for record may be formed an optical generation means for record to generate the information light and the reference beam for record which supported information, and in an information recording layer So that the record section where information was recorded with the interference pattern, and it was fixed to information may be formed in the shape of a layer the Mitsuteru gunner stage for record for irradiating information light and the reference beam for record to an information recording layer, and in an information recording layer The light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established to the field where the interference pattern was formed in the information recording layer To the Mitsuteru gunner stage for fixing and information recording layer for irradiating so that it may pass through a part of field in which the interference pattern was formed, while irradiating the reference beam for playback corresponding to the reference beam for record at the time of record It has a detection means to detect the playback light collected according to the playback optical system and this playback optical system for collecting the playback light generated from an information recording layer, by irradiating the reference beam for playback.

[0015] The optical information record playback approach according to claim 22 at the time of informational record By generating the information light and the reference beam for record which supported information, making one flux of light of information light and the reference beams for

record into a flat configuration, and irradiating information light and the reference beam for record to an information recording layer so that it may cross within an information recording layer The record section where information is recorded in an information recording layer with the interference pattern by interference with information light and the reference beam for record is formed in the shape of a layer. At the time of informational playback While irradiating the reference beam for playback corresponding to the reference beam for record at the time of record, when the reference beam for playback is irradiated by the information recording layer, the playback light generated from an information recording layer is collected, and the collected playback light is detected.

[0016] The optical information record playback approach according to claim 23 at the time of informational record So that the information light and the reference beam for record which supported information may be generated and the interference pattern by interference with information light and the reference beam for record may be formed in an information recording layer As opposed to the field where information light and the reference beam for record were irradiated to the information recording layer, and the interference pattern was formed in the information recording layer By irradiating so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established The record section where information was recorded with the interference pattern in the information recording layer, and it was fixed to information is formed in the shape of a layer. At the time of informational playback While irradiating the reference beam for playback corresponding to the reference beam for record at the time of record, when the reference beam for playback is irradiated by the information recording layer, the playback light generated from an information recording layer is collected, and the collected playback light is detected.

[0017] By the optical information recording device according to claim 1 or the optical information record approach according to claim 12, one flux of light of information light and the reference beams for record is made into a flat configuration, information light and the reference beam for record are irradiated to an information recording layer so that it may cross within an information recording layer, and the record section where information is recorded with the interference pattern by interference with information light and the reference beam for record is formed in the shape of a layer in an information recording layer.

[0018] By the optical information recording device according to claim 7 or the optical information record approach according to claim 13 So that the interference pattern by interference with information light and the reference beam for record may be formed in an information recording layer As opposed to the field where information light and the reference beam for record were irradiated to the information recording layer, and the interference pattern was formed in the information recording layer The record section where it irradiated in so that the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established might pass through a part of field in which the interference pattern was formed, and information was recorded with the interference pattern in the information recording layer, and it was fixed to information is formed in the shape of a layer.

[0019] By the optical information record regenerative apparatus according to claim 14 or the optical information record playback approach according to claim 22 At the time of informational record, one flux of light of information light and the reference beams for record is made into a flat configuration. It irradiates information light and the reference beam for record to an information recording layer so that it may cross within an information recording layer. In an information recording layer, the record section where information is recorded with the interference pattern by interference with information light and the reference beam for record is formed in the shape of a layer. At the time of informational playback The reference beam for playback corresponding to the reference beam for record at the time of record is irradiated by the information recording layer, and the playback light generated from an information recording layer is collected and detected.

[0020] By the optical information record regenerative apparatus according to claim 18 or the optical information record playback approach according to claim 23 At the time of informational record, so that the interference pattern by interference with information light and the reference beam for record may be formed in an information recording layer As opposed to the field where information light and the reference beam for record were irradiated to the information recording layer, and the interference

pattern was formed in the information recording layer The light for fixing of the flux of light of the flat configuration for being established the information recorded with an interference pattern It irradiates so that it may pass through a part of field in which the interference pattern was formed. In an information recording layer, the record section where information was recorded with the interference pattern, and it was fixed to information is formed in the shape of a layer. At the time of informational playback The reference beam for playback corresponding to the reference beam for record at the time of record is irradiated by the information recording layer, and the playback light generated from an information recording layer is collected and detected.

[0021]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to a drawing.

[0022] With reference to introduction and drawing 1 , the configuration of the optical information record medium in the gestalt of this operation is explained. Drawing 1 is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 1st of this invention, and an optical information record medium. While information is recorded using volume holography with the interference pattern by interference with the information light and the reference beam for record which supported information, the optical information record medium 1 in the gestalt of this operation The information recording layer 2 for generating the playback light corresponding to the information currently recorded, when the reference beam for playback is irradiated, It has the transparence substrate 3 formed in one field side of this information recording layer 2, the transparent positioning layer 4 prepared in the field side of another side of the information recording layer 2, and the transparent protective layer 5 prepared in the outside of this positioning layer 4. The optical information record-medium 1 whole is formed in disc-like.

[0023] The information recording layer 2 is formed with the hologram ingredient from which optical properties, such as a refractive index, a dielectric constant, and a reflection factor, change according to luminous intensity, when light is irradiated. as a hologram ingredient -- for example, the E. I. du Pont de Nemours& Co. (Dupont) make -- photopolymer (photopolymers) HRF-600 (product name) etc. is used.

[0024] Two or more address servo area which extends in radial at a line is established in the optical information record medium 1 at intervals of the predetermined include angle. This address servo area is equivalent to the positioning field in this invention. In the optical information record medium 1, the section of the sector between adjacent address servo area is a data area. Information and address information for a sample DOSABO method to perform a focus servo and a tracking servo are beforehand recorded on the field by the side of the protective layer 5 of the positioning layer 4 in address servo area by the embossing pit etc. In addition, a focus servo is irradiated from the pickup which makes a reflector the interface of the positioning layer 4 and a protective layer 5, and mentions it later, and can be performed based on the light reflected in the reflector. As information for performing a tracking servo, a wobble pit can be used, for example.

[0025] Next, with reference to drawing 5 , the configuration of the optical information record regenerative apparatus concerning the gestalt of this operation is explained. In addition, the optical information recording device concerning the gestalt of this operation is contained in this optical information record regenerative apparatus. This optical information record regenerative apparatus 10 is equipped with the spindle 81 with which the optical information record medium 1 is attached, the spindle motor 82 made to rotate this spindle 81, and the spindle servo circuit 83 which controls a spindle motor 82 to maintain the number of rotations of the optical information record medium 1 at a predetermined value. While the optical information record regenerative apparatus 10 irradiates information light and the reference beam for record to the optical information record medium 1 and records information further Irradiate the reference beam for playback to the optical information record medium 1, and playback light is detected. It has the pickup 11 for reproducing the information currently recorded on the optical information record medium 1, and the driving gear 84 which makes the close outgoing radiation location of the light in this pickup 11 movable to radial [of the optical information record medium 1]. Pickup 11 is formed in the shape of [which the close outgoing radiation section of light rotates centering on a predetermined rotation shaft] an arm, and a driving

gear 84 turns into equipment rotating around pickup 11 in this case.
[0026] The detector 85 for the optical information record regenerative apparatus 10 to detect focal error signal FE, the tracking error signal TE, and a regenerative signal RF from the output signal of pickup 11 further, It is based on focal error signal FE detected by this detector 85 and the command mentioned later from a controller. The focus servo circuit 86 which drives the actuator in pickup 11, is made to move an objective lens in the thickness direction of the optical information record medium 1, and performs a focus servo, The tracking servo circuit 87 which drives the actuator in pickup 11 based on the tracking error signal TE detected by the detector 85, is made to move an objective lens to radial [of the optical information record medium 1], and performs a tracking servo, It has the seeking control circuit 88 which controls seeking which a driving gear 84 is controlled [seeking] based on the command from the tracking error signal TE and the controller mentioned later, and moves the close outgoing radiation location of the light in pickup 11 to radial [of the optical information record medium 1].
[0027] The optical information record regenerative apparatus 10 decoded further the output data of a CCD array later mentioned in pickup 11, and is equipped with the digital disposal circuit 89 which reproduces the data recorded on the data area of the optical information record medium 1, reproduces a basic clock from the regenerative signal RF from a detector 85, or distinguishes the address, and the controller 90 which controls the optical whole information record regenerative apparatus 10. A controller 90 controls pickup 11, the spindle servo circuit 83, and seeking control circuit 88 grade while inputting the basic clock and address information which are outputted from a digital disposal circuit 89. The spindle servo circuit 83 inputs the basic clock outputted from a digital disposal circuit 89.
[0028] A detector 85, the focus servo circuit 86, the tracking servo circuit 87, and the seeking control circuit 88 correspond to the position control means in this invention.
[0029] Next, the configuration of pickup 11 is explained with reference to drawing 1 . Solid emersion lens (it is hereafter described as SIL.) 12A arranged so that pickup 11 may counter the field by the side of the transparence substrate 3 of the optical information record medium 1, when the optical information record medium 1 is fixed to a spindle 81, Objective lens 13A prepared in the opposite side in the optical information record medium 1 in this SIL12A, When the optical information record medium 1 is fixed to a spindle 81, SIL12B arranged so that the field by the side of the protective layer 5 of the optical information record medium 1 may be countered, and the optical information record medium 1 in this SIL12B are equipped with objective lens 13B prepared in the opposite side. With the gestalt of this operation, objective lens 13A and objective lens 13B are arranged so that these opticals axis may be on the same line and these opticals axis may make the include angle of 60 degrees to the field of the optical information record medium 1.
[0030] Pickup 11 equips [objective lens 13A] the direction of an optical axis, and radial [of the optical information record medium 1] with actuator 14B movable to the direction of an optical axis, and radial [of the optical information record medium 1] for movable actuator 14A and objective lens 13B further.
[0031] As for the space optical modulator 15 arranged in the opposite side sequentially from the objective lens 13A side, the beam splitter 16, the collimator lens 17 and the laser coupler 20, and the optical information record medium 1 in objective lens 13B, pickup 11 is further equipped with the CCD array 19 prepared in the opposite side in the optical information record medium 1 in objective lens 13A.
[0032] The space optical modulator 15 has the pixel of a large number arranged in the shape of a grid, and can modulate light now spatially with optical reinforcement by choosing the transparency condition (henceforth ON) and cut off state (henceforth OFF) of light for every pixel. As a space optical modulator 15, a liquid crystal display component can be used, for example. In addition, control of the space optical modulator 15 is performed under control of the controller 90 in drawing 5 by the drive circuit which is not illustrated. Moreover, the CCD array 19 has the pixel of a large number arranged in the shape of a grid.
[0033] The beam splitter 16 has semi-reflection surface 16a which the 45 degrees of the direction of a normal were leaned to the direction of an optical axis between a collimator lens 17 and the space optical modulator 15, and has been arranged. And a part of quantity of light penetrates semi-

reflection surface 16a, the light which carries out incidence to a beam splitter 16 from a collimator lens 17 side carries out incidence to the space optical modulator 15, and a part of quantity of light is reflected by semi-reflection surface 16a.
[0034] The prism 51 which pickup 11 is further arranged in the travelling direction of light reflected by semi-reflection surface 16a among the light which carries out incidence to a beam splitter 16 from a collimator lens 17 side, and has total reflection side 51a parallel to semi-reflection surface 16a, The prism 52 which has total reflection side 52a which is arranged in the travelling direction of light reflected by total reflection side 51a of this prism 51, and intersects perpendicularly with total reflection side 51a, It has the convex lens 53, the concave lens 54, and cylindrical lens 55 which were arranged in the travelling direction of light reflected by total reflection side 52a in order [side / prism 52]. The light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the information recording layer 2 so that the core (optical axis) of the light in which outgoing radiation is carried out by objective lens 13A into the information recording layer 2, and the core (optical axis) may cross at right angles. Therefore, the light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the optical information record medium 1 so that the include angle of 30 degrees may be made to the field of the optical information record medium 1.

[0035] In addition, in drawing 1 , a sign 57 shows the hand of cut of the optical information record medium 1, and the sign 58 shows the seeking direction of pickup 11.
[0036] In the pickup 11 shown in drawing 1 , the laser coupler 20 carries out outgoing radiation of the laser beam, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 16, a part of quantity of light penetrates semi-reflection surface 16a, and, as for this laser beam, a part of quantity of light is reflected by semi-reflection surface 16a. The light which penetrated semi-reflection surface 16a passes the space optical modulator 15, it is condensed by objective lens 13A, and it passes SIL12A, and is irradiated by the optical information record medium 1. This light is converged so that it may become a minor diameter most on the interface of the positioning layer 4 and a protective layer 5.
[0037] On the other hand, it is reflected in order by total reflection side 51a of prism 51, and total reflection side 52a of prism 52, the light reflected by semi-reflection surface 16a passes a convex lens 53 and a concave lens 54 in order, and the path of the flux of light is reduced. By the cylindrical lens 55, it converges only about the direction of an optical axis of objective lens 13A, and outgoing radiation light of a concave lens 54 is made into the flux of light of a flat configuration, passes SIL12A, and is irradiated by the optical information record medium 1.
[0038] The light from the objective lens 13A side and the light from a cylindrical-lens 55 side cross within the information recording layer 2 so that the core of each light may intersect perpendicularly. Moreover, the light from a cylindrical-lens 55 side becomes the thinnest on the straight line of a direction perpendicular to the space which passes along the point that the core of the light from the objective lens 13A side and the core of the light from a cylindrical-lens 55 side cross.
[0039] At the time of informational record, the light from the objective lens 13A side turns into information light, the light from a cylindrical-lens 55 side turns into a reference beam for record, and the record section 59 where information is recorded with the interference pattern by interference with such information light and the reference beam for record is formed in the shape of a layer in the information recording layer 2. This record section 59 serves as a disc-like configuration which slices a cone in the direction which intersects perpendicularly with that medial axis, and is formed.
[0040] The light which goes to the objective lens 13A side from the optical information record medium 1 passes objective lens 13A and the space optical modulator 15 in order, semi-reflection surface 16a of a beam splitter 16 is penetrated, it is condensed by the collimator lens 17, and a part of quantity of light carries out incidence of it to the laser coupler 20.
[0041] Light which goes to the objective lens 13B side from the optical information record medium 1 is made the parallel flux of light by objective lens 13B, and carries out incidence to the CCD array 19 by it. When the light from a cylindrical-lens 55 side turns into a reference beam for playback at the time of informational playback and this reference beam for playback is irradiated by the record section 59, from a record section 59, playback light is generated and this playback light carries out incidence to the CCD array 19 through objective lens 13B.

[0042] Here, with reference to drawing 2 , SIL 12A and 12B is explained in detail. First, as for SIL12A, the field by the side of the transparence substrate 3 of the optical information record medium 1 is formed in the flat surface. The field of the opposite side has two spherical-surface partial 12Aa(s) and 12Ab in the transparence substrate 3 in SIL12A. Spherical-surface partial 12Aa is formed in the location as for which the light from the objective lens 13A side carries out incidence, and is formed in the spherical-surface configuration centering on the point 61 that the light from the objective lens 13A side serves as a minor diameter most. Spherical-surface partial 12Ab is formed in the location as for which the light from a cylindrical-lens 55 side carries out incidence, and is formed in the spherical-surface configuration centering on the point 62 that the core of the light from the objective lens 13A side and the core of the light from a cylindrical-lens 55 side cross. Moreover, the refractive index of SIL12A has come to spread the refractive index of the transparence substrate 3, abbreviation, etc.
[0043] Incidence of the light from the objective lens 13A side is perpendicularly carried out to spherical-surface partial 12Aa of SIL12A, it advances, without being refracted by this spherical-surface partial 12Aa, and it is converged so that it may become a minor diameter most at a point 61. Incidence of the light from a cylindrical-lens 55 side is perpendicularly carried out to spherical-surface partial 12Ab of SIL12A, it advances, without being refracted by this spherical-surface partial 12Ab, and it is converged so that it may become the thinnest on the straight line of a direction perpendicular to the space which passes along a point 62.
[0044] With the gestalt of this operation, in case such light passes the optical information record medium 1 in not preparing SIL12A in order to carry out incidence of the light from the objective lens 13A side, and the light from a cylindrical-lens 55 side from across to the optical information record medium 1, respectively, aberration occurs in such light. With the gestalt of this operation, since the light from the objective lens 13A side and the light from a cylindrical-lens 55 side carry out incidence at right angles to SIL12A by having prepared SIL12A, respectively, the aberration of such light can be reduced sharply.
[0045] As for SIL12B, the field by the side of the protective layer 5 of the optical information record medium 1 is formed in the flat surface. The field of the protective layer 5 in SIL12B and the opposite side is formed in the spherical-surface configuration centering on the point 61 that the light from the objective lens 13A side serves as a minor diameter most. Moreover, the refractive index of SIL12B has come to spread the refractive index of a protective layer 5, abbreviation, etc.
[0046] The playback light generated in a record section 59 at the time of playback passes SIL12B, and it carries out incidence to objective lens 13B. Therefore, with the gestalt of this operation, the aberration of playback light can also be sharply reduced by having prepared SIL12B.
[0047] Drawing 3 is the sectional view showing an example of the support device of SIL 12A and 12B. Objective lens 13A is supported by the supporter material 91 in this example. The correcting lens 92 for amending optical properties, such as aberration, is formed in the SIL12A side of objective lens 13A if needed, and this correcting lens 92 is also supported by the supporter material 91. Are attached by the magnet 95 which constitutes a part of actuator 14A, and it is in the periphery side of the supporter material 91. Predetermined spacing is opened in the perimeter of this magnet 95 to a magnet 95, and the coil 96 which constitutes a part of actuator 14A is formed in it. The slider 94 is attached in the optical information record-medium 1 side of the supporter material 91 through the suspension 93. SIL12A is supported by this slider 94. A slider 94 slides on the transparence substrate 3 top of the optical information record medium 1. In addition, while opening 94a is prepared in the part which the light from the objective lens 13A side passes to a slider 94, opening 94b is prepared in the part which the light from a cylindrical-lens 55 side passes.
[0048] On the other hand, SIL12B is supported by the slider 97. A slider 97 slides on the protective layer 5 top of the optical information record medium 1. The slider 97 is attached in the supporter material 99 through the suspension 98. Although not illustrated, objective lens 13B is attached in the supporter material 99. In addition, the surrounding configuration of the supporter material 99 is the same as the surrounding configuration of the supporter material 91.
[0049] in addition, the drive which the supporter material 91 and 99 does not illustrate in order to enable exchange of the optical information record medium 1 etc. -- the optical information record medium 1 -- receiving -- contiguity -- alienation has become possible.

[0050] Drawing 4 is the side elevation showing other examples of the support device of SIL 12A and 12B. In this example, SIL 12A and 12B is supported by the supporter material 61 and 62 of a flying head mold, respectively. The supporter material 61 and 62 surfaces so that a predetermined air gap may be opened and it may counter to the optical information record medium 1 with rotation of the optical information record medium 1. in addition, the drive which the supporter material 61 and 62 does not illustrate in order to enable exchange of the optical information record medium 1 etc. also in this example -- the optical information record medium 1 -- receiving -- approach -- alienation has become possible.
[0051] The perspective view and drawing 7 which show the configuration of the laser coupler [in / in drawing 6 / drawing 1] 20 are the side elevation of the laser coupler 20. As shown in these drawings, the laser coupler 20 The semi-conductor substrate 21 with which photodetectors 25 and 26 were formed, and the prism 22 which has been arranged so that photodetectors 25 and 26 may be covered on this semi-conductor substrate 21, and was joined on the semi-conductor substrate 21, It has been arranged in the location where photodetectors 25 and 26 were formed on the semi-conductor substrate 21, and a different location, and has the semiconductor device 23 joined on the semi-conductor substrate 21, and the semiconductor laser 24 joined on this semiconductor device 23. Semiconductor laser 24 carries out outgoing radiation of the back laser beam to a front laser beam and an opposite direction while carrying out outgoing radiation of the front laser beam horizontally towards a prism 22 side. A slant face is formed in the semiconductor laser 24 side of prism 22, and this slant face is semi-reflection surface 22a which penetrates a part of return light from the optical information record medium 1 while it reflects a part of front laser beam from semiconductor laser 24 and it carries out outgoing radiation in the perpendicular direction to the semi-conductor substrate 21. Moreover, the top face of prism 22 is total reflection side 22b which carries out total reflection of the light which passes through the inside of prism 22 as shown in drawing 7 . The photodetector 27 which receives the back laser beam from semiconductor laser 24 is formed in the semiconductor device 23. The output signal of this photodetector 27 is used in order to carry out regulating automatically of the output of semiconductor laser 24. Various kinds of amplifier and other electronic parts are built in the semi-conductor substrate 21. Electronic parts, such as amplifier which drives semiconductor laser 24, are built in the semiconductor device 23.
[0052] In the laser coupler 20 shown in drawing 6 and drawing 7 , it is reflected by semi-reflection surface 22a of prism 22, and a part carries out incidence of the front laser beam from semiconductor laser 24 to the collimator lens 17 in drawing 1 . Moreover, a part penetrates semi-reflection surface 22a of prism 22, and the return light from the optical information record medium 1 condensed by the collimator lens 17 is drawn in prism 22, and goes to a photodetector 25. The half-reflective film is formed on the photodetector 25, a part of light drawn in prism 22 penetrates the half-reflective film on a photodetector 25, and it carries out incidence to a photodetector 25, and it is reflected by the half-reflective film on a photodetector 25, it is further reflected by total reflection side 22b of prism 22, and incidence of the remaining parts is carried out to a photodetector 26.
[0053] Here, as shown in drawing 7 , the light drawn in prism 22 is converged so that it may once become a minor diameter most in the middle of the optical path between a photodetector 25 and 26. And the path of the incident light to photodetectors 25 and 26 becomes equal in the focus condition converged so that the light from the laser coupler 20 may serve as a minor diameter most on the interface of the positioning layer 4 and protective layer 5 in the optical information record medium 1, and when it separates from a focus condition, the paths of the incident light to photodetectors 25 and 26 differ. Since change of the path of the incident light to photodetectors 25 and 26 becomes hard flow mutually, a focal error signal can be obtained by detecting the signal according to change of the path of the incident light to photodetectors 25 and 26. As shown in drawing 6 , photodetectors 25 and 26 have the light sensing portion trichotomized, respectively. Let light sensing portions [in / for the light sensing portion in a photodetector 25 / A1, C1, B1, and a photodetector 26] be A2, C2, and B-2. C1 and C2 are the light sensing portions of the central part between A1 and B1 and between A2 and B-2, respectively. Moreover, the parting line between each light sensing portion is arranged so that it may become the direction and parallel corresponding to the direction of a truck in the optical information record medium 1. therefore, PUYUSSHUPURU from the difference of the output between a light sensing portion A1 and B1 and between A2 and B-2 -- a tracking error signal can be

acquired by law.
[0054] In addition, control of the output of the semiconductor laser 24 in the laser coupler 20 is performed under control of the controller 90 in drawing 5 by the drive circuit which is not illustrated.

[0055] Drawing 8 is the block diagram showing the configuration of the detector 85 for detecting a focal error signal, a tracking error signal, and a regenerative signal based on the output of photodetectors 25 and 26. The adder 31 with which this detector 85 adds each output of the light sensing portions A1 and B1 of a photodetector 25, The gain control amplifier 32 which adjusts the gain of the output of this adder 31, and the gain control amplifier 33 which adjusts the gain of the output of the light sensing portion C1 of a photodetector 25, The subtractor 34 which calculates the difference of the output of the gain control amplifier 32, and the output of the gain control amplifier 33, The light sensing portion A2 of a photodetector 26, and the adder 35 adding each output of B-2, The gain control amplifier 36 which adjusts the gain of the output of this adder 35, and the gain control amplifier 37 which adjusts the gain of the output of the light sensing portion C2 of a photodetector 26, It has the subtractor 38 which calculates the difference of the output of the gain control amplifier 36, and the output of the gain control amplifier 37, and the subtractor 39 which calculates the difference of the output of a subtractor 34, and the output of a subtractor 38, and generates focal error signal FE.
[0056] The detector 85 is further equipped with the subtractor 40 which calculates the difference of the output of the light sensing portion A1 of a photodetector 25, and the output of a light sensing portion B1, the subtractor 41 which calculates the difference of the output of the light sensing portion A2 of a photodetector 26, and the output of light sensing portion B-2, and the subtractor 42 which calculates the difference of the output of a subtractor 40, and the output of a subtractor 41, and generates the tracking error signal TE. The detector 85 is equipped with the adder 45 which adds the adder 44 which adds the adder 43 adding the output of an adder 31, and the output of a light sensing portion C1, and the output of an adder 35 and the output of a light sensing portion C2 further, and the output of an adder 43 and the output of an adder 44, and generates a regenerative signal RF.
[0057] In addition, with the gestalt of this operation, a regenerative signal RF is a signal which reproduced the information recorded on the address servo area in the optical information record medium 1. A digital disposal circuit 89 synchronizes the phase of a basic clock with the phase of a regenerative signal RF by the PLL (phase simulation-ized loop formation) circuit.
[0058] Next, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained in order. The following explanation serves as explanation of the optical information record approach concerning the gestalt of this operation, and the optical information record playback approach. In addition, at the time of a servo, at the time of record, it is controlled to maintain a regular rotational frequency also at the time of any at the time of playback, and the optical information record medium 1 rotates it with a spindle motor 82.
[0059] First, the operation at the time of a servo is explained. At the time of a servo, all the pixels of the space optical modulator 15 are turned ON. The output of the outgoing radiation light of the laser coupler 20 is set as the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 13A passes through address servo area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 13A passes through address servo area.
[0060] At the time of a servo, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 16, a part of quantity of light penetrates semi-reflection surface 16a, and, as for the laser beam by which outgoing radiation was carried out from the laser coupler 20, a part of quantity of light is reflected by semi-reflection surface 16a. The light which penetrated semi-reflection surface 16a passes the space optical modulator 15, it is condensed by objective lens 13A, and it passes SIL12A, and is irradiated by the optical information record medium 1. It converges so that it may become a minor diameter most on the interface of the positioning layer 4 and a protective layer 5, it is reflected in the interface of the positioning layer 4 and a protective layer 5, and in that case, the embossing pit in address servo area becomes irregular, and this light returns to the objective

lens 13A side. This return light is made into the parallel flux of light by objective lens 13A, the space optical modulator 15 is passed, incidence is carried out to a beam splitter 16, and a part of quantity of light penetrates semi-reflection surface 16a. It is condensed by the collimator lens 17, and incidence of the return light which penetrated this semi-reflection surface 16a is carried out to the laser coupler 20, and it is detected by photodetectors 25 and 26. And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 shown in drawing 8 and a focus servo and a tracking servo are performed based on these signals based on the output of these photodetectors 25 and 26, playback of a basic clock and distinction of the address are performed.
[0061] In addition, Actuators 14A and 14B are controlled by the gestalt of this operation to interlock by the focus servo circuit 86 so that both the convergence locations (location where the flux of light serves as a minor diameter most) of the light which passes each set object lenses 13A and 13B come on the interface of the positioning layer 4 and a protective layer 5.
[0062] Next, the operation at the time of record is explained. At the time of record, ON and OFF are chosen for every pixel according to the information which records the space optical modulator 15. The output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse based on the basic clock reproduced from the regenerative signal RF. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 13A passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 13A passes a data area. While the outgoing radiation light of objective lens 13A passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 13A and 13B are being fixed.
[0063] At the time of record, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 16, a part of quantity of light penetrates semi-reflection surface 16a, and, as for the laser beam by which outgoing radiation was carried out from the laser coupler 20, a part of quantity of light is reflected by semi-reflection surface 16a. The light which penetrated semi-reflection surface 16a passes the space optical modulator 15, and according to the information to record, it becomes irregular spatially, and it turns into information light. It is condensed by objective lens 13A, and this information light passes SIL12A, and is irradiated by the optical information record medium 1. In addition, this information light is irradiated by the optical information record medium 1 so that that core may make the include angle of 60 degrees to the field of the optical information record medium 1.
[0064] On the other hand, the light reflected by semi-reflection surface 16a turns into a reference beam for record, and it is reflected in order by total reflection side 51a of prism 51, and total reflection side 52a of prism 52. A convex lens 53 and a concave lens 54 are passed in order, the path of the flux of light is reduced, by the cylindrical lens 55, it converges only about the direction of an optical axis of objective lens 13A, and considers as the flux of light of a flat configuration, SIL12A is passed, and the optical information record medium 1 irradiates. In addition, this reference beam for record is irradiated by the optical information record medium 1 so that that core may make the include angle of 30 degrees to the field of the optical information record medium 1.
[0065] The information light from the objective lens 13A side and the reference beam for record from a cylindrical-lens 55 side cross within the information recording layer 2 so that the core of each light may intersect perpendicularly. And when the interference pattern by interference of such light is formed in the part which such information light and the reference beam for record intersect and the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern by information light and the reference beam for record is recorded in volume in the information recording layer 2, and the record section 59 which consists of a volume hologram of a transparency mold (Fresnel mold) is formed in the shape of a layer. This record section 59 serves as a disc-like configuration.
[0066] Drawing 9 expresses notionally the record section 59 formed in the information recording layer 2 of the optical information record medium 1. In this drawing, a sign 63 shows address servo area and the sign 64 shows the data area. Moreover, the sign 65 shows the truck. He is trying to form five record sections 59 in the data area 64 between two adjoining address servo area 63 at equal intervals in the example shown in drawing 9 . Moreover, the embossing pit 66 is formed in the

address servo area 63. In addition, a twist is also quite large and the record section 59 and the embossing pit 66 are actually expressed with drawing 9 .

[0067] Drawing 10 expresses the record section 59 in the information recording layer 2 of the optical information record medium 1. In addition, this drawing expresses the cross section of the information recording layer 2 in alignment with radial [of the optical information record medium 1]. As shown in this drawing, in the information recording layer 2, two or more layer-like record sections 59 are formed so that a laminating may be carried out. Each record section 59 is formed in the condition that the 30 degrees of the direction of a normal inclined to the direction of a normal of the information recording layer 2.

[0068] In addition, without lapping mutually in the information recording layer 2, the location of the information light to the optical information record medium 1 and the reference beam for record is controlled by the gestalt of this operation so that two or more record sections 59 are formed.

[0069] Next, the operation at the time of playback is explained. As for the space optical modulator 15, all pixels are turned OFF at the time of playback. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 13A passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 13A passes a data area. While the outgoing radiation light of objective lens 13A passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 13A and 13B are being fixed.

[0070] At the time of playback, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 16, a part of quantity of light penetrates semi-reflection surface 16a, and, as for the laser beam by which outgoing radiation was carried out from the laser coupler 20, a part of quantity of light is reflected by semi-reflection surface 16a. The light which penetrated semi-reflection surface 16a is intercepted by the space optical modulator 15. On the other hand, the light reflected by semi-reflection surface 16a turns into a reference beam for playback corresponding to the reference beam for record. It is reflected in order by total reflection side 51a of prism 51, and total reflection side 52a of prism 52, and a convex lens 53 and a concave lens 54 are passed in order, and the path of the flux of light is reduced. By the cylindrical lens 55 It converges only about the direction of an optical axis of objective lens 13A, and considers as the flux of light of a flat configuration, SIL12A is passed, and the optical information record medium 1 irradiates.

[0071] If the reference beam for playback is irradiated by the record section 59 in the information recording layer 2, playback light will be generated from this record section 59. Outgoing radiation of this playback light is carried out out of the optical information record medium 1 from a protective layer 5 side, being spread, after converging so that it may become a minor diameter most on the interface of the positioning layer 4 and a protective layer 5. This playback light passes SIL12B and it carries out incidence to the CCD array 19 through objective lens 13B. Thus, on the CCD array 19, in the space optical modulator 15, only the part corresponding to the pixel which was ON is brightly irradiated at the time of record, the two-dimensional pattern is detected by the CCD array 19, and informational playback is performed.

[0072] In addition, at the time of playback, you may irradiate to the optical information record medium 1 continuously, and may make it irradiate the reference beam for playback intermittently at it according to the timing which a record section 59 passes. In addition, the timing which irradiates the reference beam for playback in this case is the same as the timing which makes high power the output of the outgoing radiation light of the laser coupler 20 at the time of record, and is judged based on a basic clock. Thus, when the reference beam for playback is irradiated intermittently, while being able to raise an SN ratio compared with the case where it irradiates continuously, the temperature rise of the optical information record medium 1 can be suppressed.

[0073] By the way, when detecting the two-dimensional pattern of playback light, it is necessary to position playback light and the CCD array 19 correctly, or to recognize the criteria location in the pattern of playback light from the detection data of the CCD array 19 by the CCD array 19. The latter is adopted with the gestalt of this operation. Here, with reference to drawing 11 and drawing 12 , how to recognize the criteria location in the pattern of playback light from the detection data of the CCD array 19 is explained. As shown in drawing 11 , the aperture in pickup 11 is divided into

two or more pixels 72 by the space optical modulator 15. This pixel 72 serves as a smallest unit of two-dimensional pattern data. With the gestalt of this operation, 1-bit digital data "0" or "1" is expressed by 2 pixels, one side of the 2 pixels corresponding to 1-bit information is turned on, and another side is made off. In when [both / ON or when it is both OFF], 2 pixels becomes error data. Thus, expressing 1-bit digital data by 2 pixels has the merit of being able to raise the detection precision of data by differential detection. Drawing 12 (a) expresses the 2-pixel group 73 corresponding to 1-bit digital data. The field where this group 73 exists is hereafter called data area. He is trying to include the criteria positional information which shows the criteria location in the pattern of playback light in information light with the gestalt of this operation using 2 pixels becoming error data in when [both / ON or when it is both OFF]. That is, as shown in drawing 12 (b), error data are intentionally arranged by the predetermined pattern to the field 74 of a cross with a width of face [passing through the core of aperture] of 2 pixels. The pattern of these error data is hereafter called pixel pattern for tracking. This pixel pattern for tracking serves as criteria positional information. In addition, in drawing 12 (b), a sign 75 expresses the pixel of ON and the sign 76 expresses the pixel of OFF. Moreover, the 4-pixel field 77 for a core is always turned OFF.

[0074] If the pixel pattern for tracking and the pattern corresponding to the data to record are set, it will become a two-dimensional pattern as shown in drawing 13 (a). With the gestalt of this operation, while turning OFF the upper half in drawing among fields other than a data area and turning ON a lower half further, if fields other than a condition opposite to fields other than a data area, i.e., a data area, are off and fields other than ON and a data area are ON, suppose that it is off about the pixel which touches fields other than a data area in a data area. This becomes possible [detecting the boundary part of a data area more clearly] from the detection data of the CCD array 19.

[0075] The interference pattern of the information light and the reference beam for record by which the space modulation was carried out according to the two-dimensional pattern as shown in drawing 13 (a) at the time of record is recorded on the information recording layer 2. As the pattern of the playback light obtained at the time of playback was shown in drawing 13 (b), contrast falls compared with the time of record, and the SN ratio is getting worse. Although the pattern of playback light as shown in drawing 13 (b) is detected and data are distinguished by the CCD array 19 at the time of playback, in that case, the pixel pattern for tracking is recognized and data are distinguished by making the location into a criteria location.

[0076] Drawing 14 (a) expresses notionally the contents of the data distinguished from the pattern of playback light. A-1-1 in drawing etc. -- the data whose field which attached the sign is 1 bit, respectively are expressed. With the gestalt of this operation, it divides into four fields 78A, 78B, 78C, and 78D by dividing a data area in the field 74 of a cross in which the pixel pattern for tracking was recorded. And the diagonal fields 78A and 78C are doubled, a rectangular field is formed, the diagonal fields 78B and 78D are doubled similarly, and he forms a rectangular field, and is trying to form an ECC table by arranging the field of two rectangles up and down, as shown in drawing 14 (b). An ECC table is a table of the data which added and formed error correction codes (ECC), such as the CRC (cyclic redundancy check) code, in the data which should be recorded. In addition, drawing 14 (b) can show an example of the ECC table of a n line m train, and can also design other arrays freely. Moreover, the part which the data array shown in drawing 14 (a) uses the part of the ECC tables shown in drawing 14 (b), and is not used for the data array shown in drawing 14 (a) among the ECC tables shown in drawing 14 (b) is not concerned with the contents of data, but let it be a fixed value. At the time of record, decompose into four fields 78A, 78B, 78C, and 78D, and an ECC table as shown in drawing 14 (b) is recorded on the optical information record medium 1, as shown in drawing 14 (a). At the time of playback, the data of an array as shown in drawing 14 (a) are detected, an ECC table as rearranged this and shown in drawing 14 (b) is reproduced, an error correction is performed based on this ECC table, and data are reproduced.

[0077] Recognition of the criteria location (pixel pattern for tracking) in the pattern of the above playback light and an error correction are performed by the digital disposal circuit 89 in drawing 5 .

[0078] Since the layer-like record section 59 was formed in the information recording layer 2 of the optical information record medium 1 according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation as explained above, compared with the case

where the record section of the letter of a block is formed in an information recording layer, it becomes possible to record information on high density more. Moreover, separation of each information can also be performed easily, realizing informational densification, since according to the gestalt of this operation information is recordable on high density even if it does not perform multiplex record.

[0079] Moreover, since the location of information light, the reference beam for record, and the reference beam for playback was controlled using the information recorded on the positioning layer 3 according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, while being able to position such light with a sufficient precision, consequently a remover kinky thread tee's being good and random access's becoming easy, storage capacity and a transfer rate can be enlarged.

[0080] Moreover, since it was made according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation to irradiate information light and the reference beam for record to the information recording layer 2 so that each core may intersect perpendicularly mutually, the pitch of an interference fringe can be made small and it becomes more recordable [high density].

[0081] Moreover, since SIL12A which information light, the reference beam for record, and the reference beam for playback pass, and SIL12B which playback light passes were prepared according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, the aberration generated in information light, the reference beam for record, the reference beam for playback, and playback light can be reduced sharply.

[0082] Moreover, since it was made to include the criteria positional information which shows the criteria location in the pattern of playback light in information light according to the gestalt of this operation, recognition of the pattern of playback light becomes easy.

[0083] Hereafter, some modifications in the gestalt of this operation are explained. First, although the example which records address information etc. on the positioning layer 4 in address servo area by the embossing pit beforehand was given with the gestalt of the above-mentioned implementation It sets in address servo area to the optical information record medium using the optical information record medium which does not have the positioning layer 4 including an embossing pit. The laser beam of high power is irradiated alternatively at the part near one field of the information recording layer 2, and it may be made to format by changing the refractive index of the part alternatively by recording address information etc.

[0084] Moreover, the address information of a predetermined pattern etc. may be beforehand recorded as a hologram by the same approach as record using the holography in a data area instead of recording address information etc. on the address servo area in the optical information record medium 1 by the embossing pit. Drawing 15 shows notionally the optical information record medium 1 which recorded the hologram 67 showing address information etc. on the address servo area 63 in this way.

[0085] Thus, when the hologram 67 showing address information etc. is recorded on the address servo area 63, pickup 11 is changed into the same condition as the time of playback also at the time of a servo, and the CCD array 19 detects the pattern of the playback light generated from a hologram 67. In this case, a basic clock and the address can be directly obtained from the detection data of the CCD array 19. A tracking error signal can be acquired from the information on the location of the pattern of the playback light on the CCD array 19. Moreover, a focus servo can be performed by driving objective lenses 13A and 13B so that the contrast of the playback pattern on the CCD array 19 may become max. Moreover, it is possible to carry out by driving objective lenses 13A and 13B so that the contrast of the playback pattern on the CCD array 19 may become max about a focus servo at the time of playback.

[0086] In addition, since it is necessary to perform promptly processing to the playback light from a hologram 67 as mentioned above when address information etc. is recorded as a hologram 67, an MOS mold solid state image sensor and a digital disposal circuit may use the smart photosensor (for example, refer to reference "O plus E, September, 1996, and No.202 and the 93-99th page".) accumulated on 1 chip instead of the CCD array 19. This smart photosensor has a large transfer rate, and since it has a high-speed calculation function, it becomes possible [high-speed playback being

attained, for example, reproducing at the transfer rate of G bit-per-second order] by using this smart photosensor.

[0087] Moreover, it may be made to perform formatting which records the hologram 67 showing address information etc. to the optical information record medium using the optical information record medium with which the hologram 67 which expresses address information etc. beforehand is not recorded.

[0088] Moreover, with the gestalt of operation, as shown in drawing 1 , the example which has arranged the outgoing radiation section (objective lens 13A) of information light and the outgoing radiation section (cylindrical lens 55) of the reference beam for record along the seeking direction 58 was given, but as shown in drawing 16 , the outgoing radiation section (objective lens 13A) of information light and the outgoing radiation section (cylindrical lens 55) of the reference beam for record may be arranged along the direction 68 of a truck. In this case, in the cross section which met in the direction 68 of a truck in the information recording layer 2, as shown in drawing 10 , a record section 59 will be arranged.

[0089] Moreover, although the core of information light gave the example which irradiates information light and the reference beam for record at the optical information record medium 1 to the field of the optical information record medium 1 with the gestalt of operation so that the core of nothing and the reference beam for record might make the include angle of 30 degrees for the include angle of 60 degrees to the field of the optical information record medium 1 as shown in drawing 1 The include angle which the core of information light and the core of the reference beam for record make to the field of the optical information record medium 1 is not limited to the above-mentioned example. As for drawing 17 , the core of information light shows the configuration of the pickup 70 to which it was made to irradiate information light and the reference beam for record to the field of the optical information record medium 1 at the optical information record medium 1 so that the core of nothing and the reference beam for record may make the include angle of 90 degrees for the include angle of 45 degrees to the field of the optical information record medium 1 as other examples. In the pickup 70 shown in this drawing, objective lens 13A and objective lens 13B are arranged so that these opticals axis may be on the same line and these opticals axis may make the include angle of 45 degrees to the field of the optical information record medium 1. Moreover, in pickup 70, the convex lens 53, the concave lens 54, and the cylindrical lens 55 are arranged so that these opticals axis may become perpendicular to the field of the optical information record medium 1. Moreover, a mirror 71 is formed, and he carries out total reflection of the light reflected by semi-reflection surface 16a of a beam splitter 16, and is trying to lead it to a convex lens 53 by the mirror 71 instead of the prism 51 and 52 in drawing 1 in pickup 70. The configuration of others in pickup 70 is the same as the pickup 11 shown in drawing 1 .

[0090] When the pickup 70 shown in drawing 17 is used, in the information recording layer 2, the layer-like record section 59 is perpendicularly formed to the field of the optical information record medium 1.

[0091] Next, the gestalt of operation of the 2nd of this invention is explained. The gestalt of this operation is the example in which the hologram of a reflective mold was formed. In addition, with the gestalt of this operation, the same optical information record medium 1 as the gestalt of the 1st operation is used. Moreover, the whole optical information record regenerative-apparatus configuration concerning the gestalt of this operation is the same as that of drawing 5 except for the point that the configurations of pickup differ.

[0092] Drawing 18 is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of this operation. In addition, the same sign is hereafter given to the same member as the member under pickup shown in drawing 1 , and detailed explanation is omitted. The pickup 111 in the gestalt of this operation SIL12A arranged so that the field by the side of the transparence substrate 3 of the optical information record medium 1 may be countered, when the optical information record medium 1 is fixed to a spindle 81, Objective lens 113A prepared in the opposite side in the optical information record medium 1 in this SIL12A, When the optical information record medium 1 is fixed to a spindle 81, SIL12B arranged so that the field by the side of the protective layer 5 of the optical information record medium 1 may be countered, and the optical information record medium 1 in this SIL12B are equipped with objective

lens 113B prepared in the opposite side. With the gestalt of this operation, objective lens 113A and objective lens 113B are arranged so that these opticals axis may be on the same line and these opticals axis may make the include angle of 60 degrees to the field of the optical information record medium 1.
[0093] Pickup 111 equips [objective lens 113A] the direction of an optical axis, and radial [of the optical information record medium 1] with actuator 114B movable to the direction of an optical axis, and radial [of the optical information record medium 1] for movable actuator 114A and objective lens 113B further.
[0094] As for the space optical modulator 15 arranged in the opposite side sequentially from the objective lens 113B side, the beam splitter 116, the collimator lens 17 and the laser coupler 20, and the optical information record medium 1 in objective lens 113A, pickup 111 is further equipped with the CCD array 19 prepared in the opposite side in the optical information record medium 1 in objective lens 113B.
[0095] The beam splitter 116 has semi-reflection surface 116a which the 45 degrees of the direction of a normal were leaned to the direction of an optical axis between a collimator lens 17 and the space optical modulator 15, and has been arranged. And a part of quantity of light penetrates semi-reflection surface 116a, the light which carries out incidence to a beam splitter 116 from a collimator lens 17 side carries out incidence to the space optical modulator 15, and a part of quantity of light is reflected by semi-reflection surface 116a.
[0096] Pickup 111 is arranged in the travelling direction of light further reflected by semi-reflection surface 116a among the light which carries out incidence to a beam splitter 116 from a collimator lens 17 side. The prism 121 which has total reflection side 121a parallel to semi-reflection surface 116a, The prism 122 which has total reflection side 122a which is arranged in the travelling direction of light reflected by total reflection side 121a of this prism 121, and intersects perpendicularly with total reflection side 121a, It has the convex lens 53, the concave lens 54, and cylindrical lens 55 which were arranged in the travelling direction of light reflected by total reflection side 122a in order [side / prism 122]. The light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the information recording layer 2 so that the core (optical axis) of the light in which outgoing radiation is carried out by objective lens 113B into the information recording layer 2, and the core (optical axis) may cross at right angles. Therefore, the light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the optical information record medium 1 so that the include angle of 30 degrees may be made to the field of the optical information record medium 1.

[0097] In the pickup 111 in the gestalt of this operation, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 116, a part of quantity of light penetrates semi-reflection surface 116a, and, as for the laser beam by which outgoing radiation is carried out from the laser coupler 20, a part of quantity of light is reflected by semi-reflection surface 116a. The light which penetrated semi-reflection surface 116a passes the space optical modulator 15, it is condensed by objective lens 113B, and it passes SIL12B, and is irradiated by the optical information record medium 1. This light is converged so that it may become a minor diameter most on the interface of the positioning layer 4 and a protective layer 5.
[0098] On the other hand, it is reflected in order by total reflection side 121a of prism 121, and total reflection side 122a of prism 122, the light reflected by semi-reflection surface 116a passes a convex lens 53 and a concave lens 54 in order, and the path of the flux of light is reduced. By the cylindrical lens 55, it converges only about the direction of an optical axis of objective lens 113B, and outgoing radiation light of a concave lens 54 is made into the flux of light of a flat configuration, passes spherical-surface section 12Ab of SIL12A, and is irradiated by the optical information record medium 1.
[0099] The light from the objective lens 113B side and the light from a cylindrical-lens 55 side cross within the information recording layer 2 so that the core of each light may intersect perpendicularly. Moreover, the light from a cylindrical-lens 55 side becomes the thinnest on the straight line of a direction perpendicular to the space which passes along the point that the core of the light from the objective lens 113B side and the core of the light from a cylindrical-lens 55 side cross.
[0100] At the time of informational record, the light from the objective lens 113B side turns into

information light, the light from a cylindrical-lens 55 side turns into a reference beam for record, and the record section 123 where information is recorded with the interference pattern by interference with such information light and the reference beam for record is formed in the shape of a layer in the information recording layer 2. This record section 123 serves as a disc-like configuration which slices a cone like the record section 59 in the gestalt of the 1st operation in the direction which intersects perpendicularly with that medial axis, and is formed.

[0101] The light which goes to the objective lens 113B side from the optical information record medium 1 passes objective lens 113B and the space optical modulator 15 in order, semi-reflection surface 116a of a beam splitter 116 is penetrated, it is condensed by the collimator lens 17, and a part of quantity of light carries out incidence of it to the laser coupler 20.

[0102] The light which goes to the objective lens 113A side from the optical information record medium 1 passes spherical-surface section 12Aa of SIL12A, and it is made the parallel flux of light by objective lens 113A, and it carries out incidence to the CCD array 19 by it. When the light from a cylindrical-lens 55 side turns into a reference beam for playback at the time of informational playback and this reference beam for playback is irradiated by the record section 123, from a record section 123, playback light is generated and this playback light carries out incidence to the CCD array 19 through objective lens 113A.

[0103] Next, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained in order.

[0104] First, the operation at the time of a servo is explained. At the time of a servo, all the pixels of the space optical modulator 15 are turned ON. The output of the outgoing radiation light of the laser coupler 20 is set as the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 113B passes through address servo area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 113B passes through address servo area.

[0105] At the time of a servo, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 116, a part of quantity of light penetrates semi-reflection surface 116a, and, as for the laser beam by which outgoing radiation was carried out from the laser coupler 20, a part of quantity of light is reflected by semi-reflection surface 116a. The light which penetrated semi-reflection surface 116a passes the space optical modulator 15, it is condensed by objective lens 113B, and it passes SIL12B, and is irradiated by the optical information record medium 1. It converges so that it may become a minor diameter most on the interface of the positioning layer 4 and a protective layer 5, it is reflected in the interface of the positioning layer 4 and a protective layer 5, and in that case, the embossing pit in address servo area becomes irregular, and this light returns to the objective lens 113B side. This return light is made into the parallel flux of light by objective lens 113B, the space optical modulator 15 is passed, incidence is carried out to a beam splitter 116, and a part of quantity of light penetrates semi-reflection surface 116a. It is condensed by the collimator lens 17, and incidence of the return light which penetrated this semi-reflection surface 116a is carried out to the laser coupler 20, and it is detected by photodetectors 25 and 26. And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 shown in drawing 8 and a focus servo and a tracking servo are performed based on these signals based on the output of these photodetectors 25 and 26, playback of a basic clock and distinction of the address are performed.

[0106] In addition, Actuators 114A and 114B are controlled by the gestalt of this operation to interlock by the focus servo circuit 86 so that both the convergence locations (location where the flux of light serves as a minor diameter most) of the light which passes each set object lenses 113A and 113B come on the interface of the positioning layer 4 and a protective layer 5.

[0107] Next, the operation at the time of record is explained. At the time of record, ON and OFF are chosen for every pixel according to the information which records the space optical modulator 15. The output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse based on the basic clock reproduced from the regenerative signal RF. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing

radiation light of objective lens 113B passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 113B passes a data area. While the outgoing radiation light of objective lens 113B passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 113A and 113B are being fixed.

[0108] At the time of record, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 116, a part of quantity of light penetrates semi-reflection surface 116a, and, as for the laser beam by which outgoing radiation was carried out from the laser coupler 20, a part of quantity of light is reflected by semi-reflection surface 116a. The light which penetrated semi-reflection surface 116a passes the space optical modulator 15, and according to the information to record, it becomes irregular spatially, and it turns into information light. It is condensed by objective lens 113B, and this information light passes SIL12B, and is irradiated by the optical information record medium 1. In addition, this information light is irradiated by the optical information record medium 1 so that that core may make the include angle of 60 degrees to the field of the optical information record medium 1.

[0109] On the other hand, the light reflected by semi-reflection surface 116a turns into a reference beam for record, and it is reflected in order by total reflection side 121a of prism 121, and total reflection side 122a of prism 122. A convex lens 53 and a concave lens 54 are passed in order, the path of the flux of light is reduced, by the cylindrical lens 55, it converges only about the direction of an optical axis of objective lens 113B, and considers as the flux of light of a flat configuration, spherical-surface section 12Ab of SIL12A is passed, and the optical information record medium 1 irradiates. In addition, this reference beam for record is irradiated by the optical information record medium 1 so that that core may make the include angle of 30 degrees to the field of the optical information record medium 1.

[0110] The information light from the objective lens 113B side and the reference beam for record from a cylindrical-lens 55 side cross within the information recording layer 2 so that the core of each light may intersect perpendicularly. And when the interference pattern by interference of such light is formed in the part which such information light and the reference beam for record intersect and the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern by information light and the reference beam for record is recorded in volume in the information recording layer 2, and the record section 123 which consists of a volume hologram of a reflective mold (Lippmann mold) is formed in the shape of a layer. This record section 123 serves as a disc-like configuration.

[0111] In addition, without lapping mutually in the information recording layer 2, the location of the information light to the optical information record medium 1 and the reference beam for record is controlled by the gestalt of this operation so that two or more record sections 123 are formed. The condition of the record section 123 in the information recording layer 2 of the optical information record medium 1 is the same as that of the record section 59 in the gestalt of the 1st operation shown in drawing 9 and drawing 10 .

[0112] Next, the operation at the time of playback is explained. As for the space optical modulator 15, all pixels are turned OFF at the time of playback. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 113B passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 113B passes a data area. While the outgoing radiation light of objective lens 113B passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 113A and 113B are being fixed.

[0113] At the time of playback, a collimator lens 17 considers as the parallel flux of light, incidence is carried out to a beam splitter 116, a part of quantity of light penetrates semi-reflection surface 116a, and, as for the laser beam by which outgoing radiation was carried out from the laser coupler 20, a part of quantity of light is reflected by semi-reflection surface 116a. The light which penetrated semi-reflection surface 116a is intercepted by the space optical modulator 15. On the other hand, the light reflected by semi-reflection surface 116a turns into a reference beam for playback corresponding to the reference beam for record. It is reflected in order by total reflection side 121a of

prism 121, and total reflection side 122a of prism 122, and a convex lens 53 and a concave lens 54 are passed in order, and the path of the flux of light is reduced. By the cylindrical lens 55 It converges only about the direction of an optical axis of objective lens 113B, and considers as the flux of light of a flat configuration, spherical-surface section 12Ab of SIL12A is passed, and the optical information record medium 1 irradiates.

[0114] If the reference beam for playback is irradiated by the record section 123 in the information recording layer 2, playback light will be generated from this record section 123. Outgoing radiation of this playback light is carried out out of the optical information record medium 1 from the transparence substrate 3 side, being spread. This playback light passes spherical-surface section 12Aa of SIL12A, and it carries out incidence to the CCD array 19 through objective lens 113A. Thus, on the CCD array 19, in the space optical modulator 15, only the part corresponding to the pixel which was ON is brightly irradiated at the time of record, the two-dimensional pattern is detected by the CCD array 19, and informational playback is performed.

[0115] The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 1st operation.

[0116] Next, the gestalt of operation of the 3rd of this invention is explained. The whole optical information record regenerative-apparatus configuration concerning the gestalt of this operation is the same as that of drawing 5 except for the point that the configurations of pickup differ. In addition, as an optical information record medium 1 in the gestalt of this operation, although the structure is the same as the gestalt of the 1st operation, the information recording layer 2 uses what was formed with the ingredient from which a refractive index changes with the exposures of two light from which wavelength differs.

[0117] Drawing 19 and drawing 20 are the explanatory views showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of this operation. In addition, the same sign is hereafter given to the same member as the member under pickup shown in drawing 1 , and detailed explanation is omitted. The pickup 211 in the gestalt of this operation SIL12A arranged so that the field by the side of the transparence substrate 3 of the optical information record medium 1 may be countered, when the optical information record medium 1 is fixed to a spindle 81, Objective lens 212A prepared in the opposite side in the optical information record medium 1 in this SIL12A, When the optical information record medium 1 is fixed to a spindle 81, SIL12B arranged so that the field by the side of the protective layer 5 of the optical information record medium 1 may be countered, and the optical information record medium 1 in this SIL12B are equipped with objective lens 212B prepared in the opposite side. With the gestalt of this operation, objective lens 212A and objective lens 212B are arranged so that these opticals axis may be on the same line and these opticals axis may make the include angle of 60 degrees to the field of the optical information record medium 1.

[0118] Pickup 211 equips [objective lens 212A] the direction of an optical axis, and radial [of the optical information record medium 1] with actuator 213B movable to the direction of an optical axis, and radial [of the optical information record medium 1] for movable actuator 213A and objective lens 212B further.

[0119] Pickup 211 is further equipped with 2 division rotatory-polarization plate 214A arranged in the opposite side sequentially from the objective lens 212A side, the prism block 222,223, the space optical modulator 216, the collimator lens 217, and the laser coupler 20 in the optical information record medium 1 in objective lens 212A. The convex lens 224 is arranged between the prism blocks 222,223.

[0120] Pickup 211 is further equipped with 2 division rotatory-polarization plate 214C, the prism block 215,216, and CCD array 219B which were arranged in the opposite side sequentially from the objective lens 212B side in the optical information record medium 1 in objective lens 212B. Between the prism blocks 225,226, 1/2 wavelength plate 227 and the convex lens 228 are arranged. CCD array 219A is arranged in the side of the prism block 226.

[0121] 2 division rotatory-polarization plates 214A and 214C have rotatory-polarization plate 214AR and 214CR which have been arranged in drawing 19 and drawing 20 at the upper part of an optical axis, and rotatory-polarization plate 214AL and 214CL which have been arranged in drawing 19 and drawing 20 at the lower part of an optical axis, respectively. Each rotatory-polarization plate

214AR, 214CR, 214AL, and 214CL enclose liquid crystal, for example between two transparent electrode substrates, respectively, and are constituted. rotatory-polarization plate 214AR -- between two transparent electrode substrates -- an electrical potential difference -- not impressing (it being said hereafter that it turns OFF.) -- the -45 degrees of the polarization directions of incident light are rotated -- making -- between two transparent electrode substrates -- an electrical potential difference -- impressing (it being said hereafter that it turns ON.) -- the polarization direction of incident light is not rotated. If rotatory-polarization plate 214AL is turned OFF, it will rotate the +45 degrees of the polarization directions of incident light, and if it turns ON, it will not rotate the polarization direction of incident light. If rotatory-polarization plate 214CR is turned OFF, it will rotate the +45 degrees of the polarization directions of incident light, and if it turns ON, it will not rotate the polarization direction of incident light. If rotatory-polarization plate 214CL is turned OFF, it will rotate the -45 degrees of the polarization directions of incident light, and if it turns ON, it will not rotate the polarization direction of incident light.

[0122] Polarization beam splitter side 223a which 45 degrees of prism blocks 223 were leaned to the direction of the optical axis [direction / of a normal / the] between 2 division rotatory-polarization plate 214A and the space optical modulator 216, and has been arranged, and the light from the space optical modulator 216 side are arranged in the direction reflected by polarization beam splitter side 223a, and have reflector 223b parallel to polarization beam splitter side 223a.

[0123] The light from polarization beam splitter side 222a which the 45 degrees of the direction of a normal were leaned to the direction of an optical axis between 2 division rotatory-polarization plate 214A and the space optical modulator 216, and 90 degrees of prism blocks 222 were leaned to polarization beam splitter side 223a of the prism block 223, and has been arranged, and reflector 223b of the prism block 223 is arranged in the location which carries out incidence, and has reflector 222b parallel to polarization beam splitter side 222a. The convex lens 224 is arranged between reflector 223b of the prism block 223, and reflector 222b of the prism block 222.

[0124] The space optical modulator 216 has the pixel of a large number arranged in the shape of a grid, and can modulate light now spatially by the difference in the polarization direction by choosing the polarization direction of outgoing radiation light for every pixel. Specifically, the space optical modulator 216 is a configuration equivalent to the thing except a polarizing plate in the liquid crystal display component using the optical activity of liquid crystal. Here, for every pixel, if the space optical modulator 216 is turned OFF, it will rotate the +90 degrees of the polarization directions, and if it turns ON, it will not rotate the polarization direction. As liquid crystal in the space optical modulator 216, strong dielectric liquid crystal with a quick (an microsecond of order) speed of response can be used, for example. It becomes possible to attain high-speed record by this, for example, to record the information for 1 page in several or less microseconds.

[0125] Polarization beam splitter side 225a which 45 degrees of prism blocks 225 were leaned to the direction [in / in the direction of a normal / objective lens 212B and 2 division rotatory-polarization plate 214C] of an optical axis, and has been arranged, and the light from the 2 division rotatory-polarization plate 214C side are arranged in the direction reflected by polarization beam splitter side 225a, and have reflector 225b parallel to polarization beam splitter side 225a.

[0126] The light from polarization beam splitter side 226a which the 45 degrees of the direction of a normal were leaned to the direction of an optical axis in objective lens 212B and 2 division rotatory-polarization plate 214C, and 90 degrees of prism blocks 226 were leaned to polarization beam splitter side 225a of the prism block 225, and has been arranged, and reflector 225b of the prism block 225 is arranged in the location which carries out incidence, and has reflector 226b parallel to polarization beam splitter side 226a. 1/2 wavelength plate 227 is arranged between polarization beam splitter side 225a of the prism block 225, and polarization beam splitter side 226a of the prism block 226. The convex lens 228 is arranged between reflector 225b of the prism block 225, and reflector 226b of the prism block 226.

[0127] The CCD arrays 219A and 219B have the pixel of a large number arranged in the shape of a grid, respectively. CCD array 219A is arranged in the direction in which the light which passed 1/2 wavelength plate 227 is reflected by polarization beam splitter side 226a of the prism block 226, and CCD array 219B is arranged in the direction in which it is reflected in by reflector 226b of the prism block 226, and the light which passed the convex lens 228 is further reflected by polarization beam

splitter side 226a.
[0128] Pickup 211 is equipped with the collimator lens 232 arranged in order [side / light source 231] on the optical path of the light for fixing by which outgoing radiation is carried out more nearly further than the light source 231 which carries out outgoing radiation of the light for fixing, and this light source 231, the convex lens 53, the concave lens 54, and the cylindrical lens 55. The light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the information recording layer 2 so that the core (optical axis) of the light in which outgoing radiation is carried out by objective lens 212A into the information recording layer 2, and the core (optical axis) may cross at right angles. Therefore, the light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the optical information record medium 1 so that the include angle of 30 degrees may be made to the field of the optical information record medium 1.
[0129] In the pickup 211 shown in drawing 19 and drawing 20 , by the collimator lens 217, outgoing radiation of the laser beam of S polarization (linearly polarized light with the polarization direction perpendicular to plane of incidence (space of drawing 19)) is carried out, the laser coupler 20 is made into the parallel flux of light, and this laser beam passes the space optical modulator 216, and it carries out incidence to polarization beam splitter side 223a of the prism block 223. The light which passed the off pixel of the space optical modulator 216 here Become P polarization (linearly polarized light with the polarization direction parallel to plane of incidence), and polarization beam splitter side 223a is penetrated. Incidence is carried out to the prism block 222, polarization beam splitter side 222a is penetrated, and 2 division rotatory-polarization plate 214A is passed. By objective lens 212A It converges so that it may become a minor diameter most within the optical information record medium 1, and spherical-surface section 21Aa of SIL12A is passed, and the optical information record medium 1 irradiates. On the other hand, the light which passed the pixel of ON of the space optical modulator 216 Are still S polarization and it is reflected by polarization beam splitter side 223a. Furthermore, after being reflected by reflector 223b and condensed with the convex lens 224, Incidence is carried out to the prism block 222, it is reflected in order by reflector 222b and polarization beam splitter side 222a, and 2 division rotatory-polarization plate 214A is passed. By objective lens 212A It converges so that it may become a minor diameter from the light which passed the off pixel of the space optical modulator 216 in the optical information record medium 1 most in the location of a near side, and spherical-surface section 12Aa of SIL12A is passed, and the optical information record medium 1 irradiates.
[0130] The return light from the optical information record medium 1 to the objective lens 212A side passes objective lens 212A and 2 division rotatory-polarization plate 214A in order, and they carry out incidence to polarization beam splitter side 222a of the prism block 222. Polarization beam splitter side 222a is penetrated, polarization beam splitter side 223a of the prism block 223 is penetrated further, the space optical modulator 216 is passed, it is condensed by the collimator lens 217, and incidence of the light of P polarization of this return light is carried out to the laser coupler 20.
[0131] From the optical information record medium 1, the playback light by which outgoing radiation is carried out to the objective lens 212B side passes objective lens 212B and 2 division rotatory-polarization plate 214C in order, and they carry out incidence to polarization beam splitter side 225a of the prism block 225. The light of P polarization of this playback light penetrates polarization beam splitter side 225a, and the 90 degrees of the polarization directions rotate, they serve as light of S polarization, are reflected by 1/2 wavelength plate 227 by polarization beam splitter side 226a of the prism block 226, and it carries out incidence to CCD array 219A with it. On the other hand, after being reflected by polarization beam splitter side 225a, being further reflected by reflector 225b, being condensed with a convex lens 228 and making light of S polarization of the playback light into the parallel flux of light, incidence is carried out to the prism block 226, it is reflected in order by reflector 226b and polarization beam splitter side 226a, and incidence of it is carried out to CCD array 219B.
[0132] The plastic material (PMMA) which doped the two-wave sensitization photochromic matter as shown in U.S. Pat. No. 5,268,862, for example as an ingredient which forms the information recording layer 2 in the gestalt of this operation can be used. If the light whose wavelength is 532nm, and the light whose wavelength is 1064nm are irradiated by coincidence, they will change to the

merocyanine (merocyanine) which is the molecule gestalt which changed to the SUPIRO pyran (spiropyran) at first, and then was stabilized, and as for this ingredient, a refractive index changes.
[0133] It explains taking the case of the case where the above-mentioned plastic material is hereafter used as an ingredient which forms the information recording layer 2. In this case, more for example, than the light source 231, make into light with a wavelength of 532nm information light and the reference beam for record, i.e., the light by which outgoing radiation is carried out from the laser coupler 20, and let light for fixing by which outgoing radiation is carried out be light with a wavelength of 1064nm. In addition, as a light with a wavelength of 1064nm, the fundamental wave of neodium YAGU (Nd:YAG) laser can be used, for example. In being able to use the 2nd higher harmonic acquired, for example through a nonlinear optics medium as a light with a wavelength of 532nm in the fundamental wave of a neodium yag laser and using this 2nd higher harmonic, it uses the light equipment made to generate this 2nd higher harmonic instead of the semiconductor laser 24 in the laser coupler 20.
[0134] Next, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained in order.
[0135] First, the operation at the time of a servo is explained. At the time of a servo, all the pixels of the space optical modulator 216 are turned OFF, and all of each rotatory-polarization plate 214AR of 2 division rotatory-polarization plates 214A and 214C, 214AL, 214CR, and 214CL are turned ON. The output of the outgoing radiation light of the laser coupler 20 is set as the low-power output for playback. Moreover, the light source 231 does not carry out outgoing radiation of the light for fixing. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 212A passes through address servo area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 212A passes through address servo area.
[0136] At the time of a servo, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 217, and carries out incidence to the space optical modulator 216 by it. Here, since all the pixels of the space optical modulator 216 are turned OFF, the +90 degrees of the polarization directions rotate, and the light of Ushiro who passed the space optical modulator 216 turns into P polarization. The light of this P polarization penetrates polarization beam splitter side 223a of the prism block 223, and polarization beam splitter side 222a of the prism block 222 in order, and they carry out incidence to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned ON, light passes 2 division rotatory-polarization plate 214A, without being influenced at all. It is condensed by objective lens 212A, it converges so that it may become a minor diameter most on the interface of the positioning layer 4 and protective layer 5 in the information record medium 1, and the light which passed 2 division rotatory-polarization plate 214A is irradiated by the information record medium 1. It is reflected in the interface of the positioning layer 4 and protective layer 5 in the information record medium 1, and in that case, the embossing pit in address servo area becomes irregular, and this light returns to the objective lens 212A side. This return light is made into the parallel flux of light by objective lens 212A, and 2 division rotatory-polarization plate 214A is passed, without being influenced at all. Polarization beam splitter side 222a of the prism block 222 and polarization beam splitter side 223a of the prism block 223 are penetrated in order. The space optical modulator 216 is passed, and the +90 degrees of the polarization directions rotate, they are again considered as S polarization, carry out incidence to the laser coupler 20, and are detected by photodetectors 25 and 26. And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 and a focus servo and a tracking servo are performed based on these signals based on the output of these photodetectors 25 and 26, playback of a basic clock and distinction of the address are performed.
[0137] With the gestalt of this operation, Actuators 213A and 213B are controlled to interlock by the focus servo circuit 86, and the convergence location (location where the flux of light serves as a minor diameter most) of each light which passes objective lenses 212A and 212B moves them, maintaining position relation. And in performing informational record or playback to the information

recording layer 2, it is completed by the light from objective lens 212A so that it may become a minor diameter most on the interface of the positioning layer 4 and protective layer 5 in the information record medium 1, and objective lens 212B carries out a focus servo to the condition of making into the parallel flux of light emission light which serves as a minor diameter most on the front face of the transparence substrate 3.

[0138] Next, the operation at the time of record is explained. At the time of record, the space optical modulator 216 chooses ON (0 degree) and OFF (+90 degrees) for every pixel according to the information to record. The gestalt of this operation expresses 1-bit information by 2 pixels. In this case, one side of the 2 pixels corresponding to 1-bit information is turned on, and another side is surely made off. Moreover, all of each rotatory-polarization plate 214AR of 2 division rotatory-polarization plates 214A and 214C, 214AL, 214CR, and 214CL are turned OFF. The output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse. Moreover, the light source 231 carries out outgoing radiation of the light for fixing intermittently according to the timing from which the output of the outgoing radiation light of the laser coupler 20 turns into high power. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 212A passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 212A passes a data area. While the outgoing radiation light of objective lens 212A passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 212A and 212B are being fixed.

[0139] Here, A polarization and B polarization which are used by next explanation are defined as follows. With the gestalt of this operation, as shown in drawing 21 , A polarization is seen from the objective lens 212A side, and S polarization is made into the linearly polarized light which rotated the +45-degree polarization direction for -45 degrees or P polarization, and B polarization looks at it from the objective lens 212A side, and let S polarization be the linearly polarized light which rotated the -45-degree polarization direction for +45 degrees or P polarization. As for A polarization and B polarization, the polarization direction lies at right angles mutually.

[0140] At the time of record, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 217, and carries out incidence to the space optical modulator 216 by it. Here, the light which passed the pixel turned ON among the space optical modulators 216 serves as as [S polarization], without the polarization direction rotating, the +90 degrees of the polarization directions rotate, and the light which passed the pixel turned OFF turns into P polarization.

[0141] The light of P polarization from the space optical modulator 216 penetrates polarization beam splitter side 223a of the prism block 223, and polarization beam splitter side 222a of the prism block 222 in order, and they carry out incidence to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214AR, turned into B polarization, and passed rotatory-polarization plate 214AL, and it becomes A polarization. On the interface of the positioning layer 4 and a protective layer 5, this light is converged so that it may become a minor diameter most.

[0142] After being reflected by polarization beam splitter side 223a of the prism block 223, being further reflected by reflector 223b and being condensed with a convex lens 224, incidence is carried out to the prism block 222, it is reflected in order by reflector 222b and polarization beam splitter side 222a, and incidence of the light of S polarization from the space optical modulator 216 is carried out to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214AR, turned into A polarization, and passed rotatory-polarization plate 14AL, and it becomes B polarization. This light is the front face of the transparence substrate 3, and it is converged so that it may become a minor diameter most.

[0143] In the information recording layer 2, the light of B polarization from rotatory-polarization plate 214AR and the light of B polarization from rotatory-polarization plate 214AL interfere. When

the light of A polarization from rotatory-polarization plate 214AR and the light of A polarization from rotatory-polarization plate 214AL interfere and the output of the outgoing radiation light of the laser coupler 20 turns into high power The interference pattern by such light is recorded in volume in the information recording layer 2, and the volume hologram of a transparency mold (Fresnel mold) is formed. In addition, since the polarization direction intersects perpendicularly mutually, it does not interfere in the light of A polarization, and the light of B polarization. Thus, with the gestalt of this operation, since the flux of light is divided into two and the polarization direction of the light for every field is made to intersect perpendicularly, generating of an excessive interference fringe can be prevented and the fall of an SN ratio can be prevented.

[0144] Moreover, with the gestalt of this operation, the light converged so that it may become a minor diameter most by the back side of the information recording layer 2, and the light converged so that it may become a minor diameter most by the near side of the information recording layer 2 have the complementary pattern of each other, and can be regarded as the information light which supported the information which should record all on the information recording layer 2. The light converged so that it may become a minor diameter most by the near side of the information recording layer 2 when the light converged so that it may become a minor diameter most by the back side of the information recording layer 2 is seen as an information light turns into a reference beam for record, and when the light converged so that it may become a minor diameter most by the near side of the information recording layer 2 is seen as an information light, the light converged so that it may become a minor diameter most by the back side of the information recording layer 2 turns into the reference beam for record conversely.

[0145] After light for fixing by which outgoing radiation was carried out from the light source 231 is made the parallel flux of light by the collimator lens 232, a convex lens 53 and a concave lens 54 are passed in order, the path of the flux of light is reduced, and by the cylindrical lens 55, it converges only about the direction of an optical axis of objective lens 212A, and it is made into the flux of light of a flat configuration, passes spherical surface section 12Ab of SIL12A, and is irradiated by the optical information record medium 1. In addition, this light for fixing is irradiated by the optical information record medium 1 so that that core may make the include angle of 30 degrees to the field of the optical information record medium 1. The record section 259 where it was fixed to the information on the part which this light for fixing passed through a part of field in which the interference pattern was formed within the information recording layer 2, consequently the light for fixing passed, and information was recorded with the interference pattern, and it was fixed to information is formed in the shape of a layer. Specifically, informational fixing is performed by [as being the following]. That is, if the light for fixing with a wavelength of 1064nm is irradiated as opposed to the field in which the interference pattern by interference with information light with a wavelength of 532nm and the reference beam for record was formed in the information recording layer 2, in the information recording layer 2, a molecule gestalt will change partially according to an interference pattern, consequently the refractive-index distribution according to an interference pattern will arise, and it will be fixed to information.

[0146] Next, the operation at the time of playback is explained. At the time of playback, as for the space optical modulator 216, the condition of OFF (+90 degrees) of all pixels and the condition of ON (0 degree) of all pixels are chosen if needed. Moreover, all of each rotatory-polarization plate 214AR of 2 division rotatory-polarization plates 214A and 214C, 214AL, 214CR, and 214CL are turned OFF. The output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for playback. Moreover, the light source 231 does not carry out outgoing radiation of the light for fixing. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 212A passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 212A passes a data area. While the outgoing radiation light of objective lens 212A passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 212A and 212B are being fixed.

[0147] When all the pixels of the space optical modulator 216 are in the condition of OFF, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 217, with the space optical modulator 216, the

+90 degrees of the polarization directions rotate, and they serve as P polarization. The light of P polarization from the space optical modulator 216 penetrates polarization beam splitter side 223a of the prism block 223, and polarization beam splitter side 222a of the prism block 222 in order, and they carry out incidence to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214AR, turned into B polarization, and passed rotatory-polarization plate 214AL, and it becomes A polarization. On the interface of the positioning layer 4 and a protective layer 5, this light is converged so that it may become a minor diameter most.

[0148] From the record section 259 in the information recording layer 2, the playback light at the time of regarding the light converged so that it may become a minor diameter most by the back side of the information recording layer 2 as the reference beam for record is generated. The playback light in this case is an emission light which serves as a minor diameter most by the near side of the information recording layer 2. If it explains in more detail, in the field in the upper half of a record section 259, the light of B polarization from rotatory-polarization plate 214AR will be irradiated, it will irradiate from rotatory-polarization plate 214AL of 2 division rotatory-polarization plate 214A at the time of record, and the playback light corresponding to the light which serves as a minor diameter most by the near side of the information recording layer 2 will be generated. It is the light of B polarization, and it is condensed by objective lens 212B, and this playback light serves as the parallel flux of light, it passes rotatory-polarization plate 214CR of 2 division rotatory-polarization plate 214C, and turns into light of P polarization. Similarly, in the field in the lower half of a record section 259, the light of A polarization from rotatory-polarization plate 214AL is irradiated, it irradiates from rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A at the time of record, and the playback light corresponding to the light which serves as a minor diameter most by the near side of the information recording layer 2 is generated. It is the light of A polarization, and it is condensed by objective lens 212B, and this playback light serves as the parallel flux of light, it passes rotatory-polarization plate 214CL of 2 division rotatory-polarization plate 214C, and turns into light of P polarization. The playback light of these P polarization penetrates polarization beam splitter side 225a of the prism block 225, and the 90 degrees of the polarization directions rotate, they serve as light of S polarization, are reflected by 1/2 wavelength plate 227 by polarization beam splitter side 226a of the prism block 226, and it carries out image formation on CCD array 229A with it. Thus, on CCD array 219A, in the space optical modulator 216, only the part corresponding to the pixel which was ON is brightly irradiated at the time of record, the two-dimensional pattern is detected by CCD array 219A, and informational playback is performed.

[0149] On the other hand, when all the pixels of the space optical modulator 216 are in the condition of ON, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 17, and serves as as [S polarization], without the polarization direction rotating with the space optical modulator 216. It is reflected by polarization beam splitter side 223a of the prism block 223, and is further reflected by reflector 223b, and incidence is carried out to the prism block 222, it is reflected in order by reflector 222b and polarization beam splitter side 222a, and incidence of the light of S polarization from the space optical modulator 216 is carried out to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214AR, turned into A polarization, and passed rotatory-polarization plate 214AL, and it becomes B polarization. On the front face of the transparence substrate 3, this light is converged so that it may become a minor diameter most.

[0150] From the record section 259 in the information recording layer 2, the playback light at the time of regarding the light converged so that it may become a minor diameter most by the near side of the information recording layer 2 as the reference beam for record is generated. The playback light in this case is an emission light which serves as a minor diameter most by the back side of the information recording layer 2. If it explains in more detail, in the field in the upper half of a record

section 259, the light of B polarization from rotatory-polarization plate 214AL will be irradiated, it will irradiate from rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A at the time of record, and the playback light corresponding to the light which serves as a minor diameter most by the back side of the information recording layer 2 will be generated. It is the light of B polarization, and this playback light serves as the flux of light which it is condensed by objective lens 212B, and is diffused a little, it passes rotatory-polarization plate 214CL of 2 division rotatory-polarization plate 214C, and turns into light of S polarization. Similarly, in the field in the lower half of a record section 259, the light of A polarization from rotatory-polarization plate 214AR is irradiated, it irradiates from rotatory-polarization plate 214AL of 2 division rotatory-polarization plate 214A at the time of record, and the playback light corresponding to the light which serves as a minor diameter most by the back side of the information recording layer 2 is generated. It is the light of A polarization, and this playback light serves as the flux of light which it is condensed by objective lens 212B, and is diffused a little, it passes rotatory-polarization plate 214CR of 2 division rotatory-polarization plate 214C, and turns into light of S polarization. It is reflected by polarization beam splitter side 225a of the prism block 225, and is further reflected by reflector 225b, and it is condensed with a convex lens 228, becomes the parallel flux of light, it is reflected in order by reflector 226b of the prism block 226, and polarization beam splitter side 226a, and image formation of the playback light of these S polarization is carried out on CCD array 229B. Thus, on CCD array 229B, in the space optical modulator 216, only the part corresponding to the off pixel is brightly irradiated at the time of record, the two-dimensional pattern is detected by CCD array 229B, and informational playback is performed.

[0151] With the gestalt of this operation, all the pixels of the space optical modulator 216 may reproduce information by CCD array 219A as an off condition, and all the pixels of the space optical modulator 216 may reproduce information by CCD array 219B as a condition of ON. With the gestalt of this operation, the condition of OFF of all the pixels of the space optical modulator 216 per record section 259 of one unit and the condition of ON of all the pixels of the space optical modulator 216 are switched. Furthermore, irradiate two kinds of reference beams for playback in time sharing, or Or the moiety of all the pixels of the space optical modulator 216 is turned off, for example, two kinds of reference beams for playback are irradiated by setting a moiety to ON at coincidence, and information can also be reproduced using the both sides of the CCD arrays 219A and 219B. In this case, since two playback light obtained by the CCD arrays 219A and 219B about the record section 259 of one unit has the complementary pattern of each other, they can reproduce information by the so-called differential detection by searching for the difference of two playback light. Thus, when reproducing information by differential detection, by the digital disposal circuit 89 in drawing 5 , to each output signal of the CCD arrays 219A and 219B, amendment which doubles magnitude, and the location and signal level of each pattern detected by the CCD arrays 219A and 219B is performed, the difference of each signal after amendment is calculated, and, specifically, information is reproduced.

[0152] According to the optical information record regenerative apparatus concerning the gestalt of this operation, to the optical information record medium 1, information can be recorded at any time, and it can be established, and it becomes possible to use the optical information record medium 1 as a record medium of a postscript mold (write-once mold).

[0153] In addition, with the gestalt of this operation, if light with a wavelength of 1064nm is irradiated as opposed to the information recording layer 2 on which information was recorded with an interference pattern, merocyanine will emit the fluorescence which is the wavelength of 532nm. Then, by observing this fluorescence, an interference pattern can be observed and the check of the existence of an interference pattern etc. is attained.

[0154] The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 1st operation.

[0155] Next, the gestalt of operation of the 4th of this invention is explained. The whole optical information record regenerative-apparatus configuration concerning the gestalt of this operation is the same as that of drawing 5 except for the point that the configurations of pickup differ. In addition, the information recording layer 2 uses what was formed with the ingredient from which a refractive index changes with the exposures of two light from which wavelength differs like the

gestalt of the 3rd operation as an optical information record medium 1 in the gestalt of this operation.

[0156] Drawing 22 and drawing 23 are the explanatory views showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of this operation. In addition, the same sign is hereafter given to the same member as the member under pickup shown in drawing 1 , drawing 19 , and drawing 20 , and detailed explanation is omitted. The pickup 311 in the gestalt of this operation is equipped with the same SIL 12A and 12B as the gestalt of the 3rd operation, objective lenses 212A and 212B, actuator 213A, actuator 213B, and 2 division rotatory-polarization plate 214A. Moreover, pickup 311 is equipped with 2 division rotatory-polarization plate 214B instead of 2 division rotatory-polarization plate 214C in the gestalt of the 3rd operation. Moreover, pickup 311 is equipped with the same light source 231 as a gestalt, the collimator lens 232, the convex lens 53, the concave lens 54, and cylindrical lens 55 of the 3rd operation.
[0157] Pickup 311 is further equipped with convex lens 318A and CCD array 219A which were arranged in prism block 315A arranged in the opposite side sequentially from the 2 division rotatory-polarization plate 214A side, the space optical modulator 216, a collimator lens 217 and the laser coupler 20, and the side of prism block 315A in the optical information record medium 1 in 2 division rotatory-polarization plate 214A.
[0158] Pickup 311 is further equipped with prism block 315B arranged in the opposite side sequentially from the 2 division rotatory-polarization plate 214B side, convex lens 318B, and CCD array 219B in the optical information record medium 1 in 2 division rotatory-polarization plate 214B.
[0159] 2 division rotatory-polarization plate 214B has rotatory-polarization plate 214BR arranged in drawing 23 at the upper part of an optical axis, and rotatory-polarization plate 214BL arranged in drawing 23 at the lower part of an optical axis. Each rotatory-polarization plate 214BR and 214BL enclose liquid crystal, for example between two transparent electrode substrates, respectively, and are constituted. If rotatory-polarization plate 214BR rotates the -45 degrees of the polarization directions of the incident light turned OFF and is turned ON, it will not rotate the polarization direction of incident light. On the other hand, if rotatory-polarization plate 214BL is turned OFF, it will rotate the +45 degrees of the polarization directions of incident light, and if it turns ON, it will not rotate the polarization direction of incident light.
[0160] Prism block 315A is set between 2 division rotatory-polarization plate 214A and the space optical modulator 216, and the light from the polarization beam splitter side 315 Aa and space optical modulator 216 side which the 45 degrees of the direction of a normal were leaned to the direction of an optical axis between 2 division rotatory-polarization plate 214A and the space optical modulator 216, and have been arranged is arranged in the direction reflected by polarization beam splitter side 315Aa, and it has reflector 315Ab parallel to polarization beam splitter side 315Aa.
[0161] In between 2 division rotatory-polarization plate 214B and convex lens 318B, prism block 315B is arranged in polarization beam splitter side 315Ba arranged in parallel to polarization beam splitter side 315Aa in prism block 315A, and the location as for which the light from reflector 315Ab in prism block 315A carries out incidence, and has reflector 315Bb perpendicular to polarization beam splitter side 315Ba.
[0162] each reflector 315 in the prism blocks 315A and 315B -- Ab and 315Bb are arranged in the side of the optical information record medium 1, and the light which goes to reflector 315Bb from reflector 315Ab passes through the side of the optical information record medium 1. In addition, the optical path of the light which goes to reflector 315Bb from reflector 315Ab is arranged so that it may not lap with the optical path of the light for fixing.
[0163] In pickup 311, by the collimator lens 217, outgoing radiation of the laser beam of S polarization is carried out, the laser coupler 20 is made into the parallel flux of light, and this laser beam passes the space optical modulator 216, and it carries out incidence to polarization beam splitter side 315Aa of prism block 315A. Here, it becomes P polarization, polarization beam splitter side 315Aa is penetrated, 2 division rotatory-polarization plate 214A is passed, it is condensed by objective lens 212A, and the light which passed the off pixel of the space optical modulator 216 is irradiated by the optical information record medium 1. It is still S polarization, is reflected by

polarization beam splitter side 315Aa, and is further reflected by reflector 315Ab, incidence is carried out to prism block 315B, it is reflected in order by reflector 315Bb and polarization beam splitter side 315Ba, 2 division rotatory-polarization plate 214B is passed, it is condensed by objective lens 212B, and the light which, on the other hand, passed the pixel of ON of the space optical modulator 216 is irradiated by the optical information record medium 1.

[0164] The light which goes to the objective lens 212A side from the optical information record medium 1 passes objective lens 212A and 2 division rotatory-polarization plate 214A in order, and they carry out incidence to polarization beam splitter side 315Aa of prism block 315A. It is reflected by polarization beam splitter side 315Aa, it is condensed by convex lens 318A, and incidence of the light of S polarization of this light is carried out to CCD array 219A. On the other hand, polarization beam splitter side 315Aa is penetrated, the space optical modulator 216 is passed, it is condensed by the collimator lens 217, and incidence of the light of P polarization of the light which goes to the objective lens 212A side from the optical information record medium 1 is carried out to the laser coupler 20.

[0165] The light which goes to the objective lens 212B side from the optical information record medium 1 passes objective lens 212B and 2 division rotatory-polarization plate 214B in order, and they carry out incidence to polarization beam splitter side 315Ba of prism block 315B. The light of S polarization of this light is reflected by polarization beam splitter side 315Ba, polarization beam splitter side 315Ba is penetrated, it is condensed by convex lens 318B, and incidence of the light of P polarization is carried out to CCD array 219B.

[0166] Next, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained in order.

[0167] First, the operation at the time of a servo is explained. At the time of a servo, all the pixels of the space optical modulator 216 are turned OFF, and all of each rotatory-polarization plate 214AR of 2 division rotatory-polarization plates 214A and 214B, 214AL, 214BR, and 214BL are turned ON. The output of the outgoing radiation light of the laser coupler 20 is set as the low-power output for playback. Moreover, the light source 231 does not carry out outgoing radiation of the light for fixing. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 212A passes through address servo area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lens 212A passes through address servo area.

[0168] At the time of a servo, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 217, and carries out incidence to the space optical modulator 216 by it. Here, since all the pixels of the space optical modulator 216 are turned OFF, the +90 degrees of the polarization directions rotate, and the light of Ushiro who passed the space optical modulator 216 turns into P polarization. The light of this P polarization penetrates polarization beam splitter side 315Aa of prism block 315A, and it carries out incidence to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned ON, light passes 2 division rotatory-polarization plate 214A, without being influenced at all. It is condensed by objective lens 212A, it converges so that it may become a minor diameter most on the interface of the positioning layer 4 and a protective layer 5, and the light which passed 2 division rotatory-polarization plate 214A is irradiated by the information record medium 1. It is reflected in the interface of the positioning layer 4 and a protective layer 5, and in that case, the embossing pit in address servo area becomes irregular, and this light returns to the objective lens 212A side. This return light is made into the parallel flux of light by objective lens 212A, passes 2 division rotatory-polarization plate 214A, without being influenced at all, penetrates polarization beam splitter side 315Aa of prism block 315A, passes the space optical modulator 216, and the +90 degrees of the polarization directions rotate, they are again considered as S polarization, and incidence of it is carried out to the laser coupler 20, and it is detected by photodetectors 25 and 26. And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 and a focus servo and a tracking servo are performed based on these signals based on the output of these photodetectors 25 and 26, playback of a basic clock and distinction of the address are

performed.
[0169] Next, the operation at the time of record is explained. At the time of record, the space optical modulator 216 chooses ON (0 degree) and OFF (+90 degrees) for every pixel according to the information to record. Moreover, all of each rotatory-polarization plate 214AR of 2 division rotatory-polarization plates 214A and 214B, 214AL, 214BR, and 214BL are turned OFF. The output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse. Moreover, the light source 231 carries out outgoing radiation of the light for fixing intermittently according to the timing from which the output of the outgoing radiation light of the laser coupler 20 turns into high power. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lenses 212A and 212B passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lenses 212A and 212B passes a data area. While the outgoing radiation light of objective lenses 212A and 212B passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 212A and 212B are being fixed.
[0170] At the time of record, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 217, and carries out incidence to the space optical modulator 216 by it. Here, the light which passed the pixel turned ON among the space optical modulators 216 serves as as [S polarization], without the polarization direction rotating, the +90 degrees of the polarization directions rotate, and the light which passed the pixel turned OFF turns into P polarization.
[0171] The light of P polarization from the space optical modulator 216 penetrates polarization beam splitter side 315Aa of prism block 315A, and it carries out incidence to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214AR, turned into B polarization, and passed rotatory-polarization plate 214AL, and it becomes A polarization. On the interface of the positioning layer 4 and a protective layer 5, this light is converged so that it may become a minor diameter most.
[0172] It is reflected by polarization beam splitter side 315Aa of prism block 315A, and is further reflected by reflector 315Ab, and incidence is carried out to prism block 315B, it is reflected in order by reflector 315Bb and polarization beam splitter side 315Ba, and incidence of the light of S polarization from the space optical modulator 216 is carried out to 2 division rotatory-polarization plate 214B. Here, since both rotatory-polarization plate 214BR of 2 division rotatory-polarization plate 214B and 214BL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214BR, turned into B polarization, and passed rotatory-polarization plate 14BL, and it becomes A polarization. This light is the front face of the transparence substrate 3, and it is converged so that it may become a minor diameter most.
[0173] In the information recording layer 2, the light of B polarization from rotatory-polarization plate 214AR and the light of B polarization from rotatory-polarization plate 214BR interfere. The light of A polarization from rotatory-polarization plate 214AL and the light of A polarization from rotatory-polarization plate 214BL interfere, and an interference pattern is formed. The record section 260 where it was fixed to the information on the part which the light for fixing passed through a part of field in which the interference pattern was formed within the information recording layer 2, consequently the light for fixing passed, and information was recorded with the interference pattern, and it was fixed to information is formed in the shape of a layer. With the gestalt of this operation, a record section 260 serves as a volume hologram of a reflective mold (Lippmann mold).
[0174] With the gestalt of this operation, the light from 2 division rotatory-polarization plate 214A and the light from 2 division rotatory-polarization plate 214B which are mutually irradiated from an opposite direction to the information recording layer 2 have the complementary pattern of each other, and can be regarded as the information light which supported the information which should record all on the information recording layer 2. When the light from 2 division rotatory-polarization plate 214A is seen as an information light, the light from 2 division rotatory-polarization plate 214B turns into a reference beam for record, and conversely, when the light from 2 division rotatory-

polarization plate 214B is seen as an information light, the light from 2 division rotatory-polarization plate 214A turns into a reference beam for record.
[0175] Next, the operation at the time of playback is explained. At the time of playback, as for the space optical modulator 216, the condition of OFF (+90 degrees) of all pixels and the condition of ON (0 degree) of all pixels are chosen if needed. Moreover, all of each rotatory-polarization plate 214AR of 2 division rotatory-polarization plates 214A and 214B, 214AL, 214BR, and 214BL are turned OFF. The output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setup, while the timing to which the outgoing radiation light of objective lens 212A passes a data area is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of objective lenses 212A and 212B passes a data area. While the outgoing radiation light of objective lenses 212A and 212B passes a data area, a focus servo and a tracking servo are not performed, but objective lenses 212A and 212B are being fixed.
[0176] When all the pixels of the space optical modulator 216 are in the condition of OFF, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 217, with the space optical modulator 216, the +90 degrees of the polarization directions rotate, and they serve as P polarization. The light of P polarization from the space optical modulator 216 penetrates polarization beam splitter side 315Aa of prism block 315A, and it carries out incidence to 2 division rotatory-polarization plate 214A. Here, since both rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A and 214AL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214AR, turned into B polarization, and passed rotatory-polarization plate 214AL, and it becomes A polarization. On the interface of the positioning layer 4 and a protective layer 5, this light is converged so that it may become a minor diameter most.
[0177] From the record section 260 in the information recording layer 2, the playback light at the time of regarding the light converged so that it may see from objective lens 212A and may become a minor diameter most by the back side of the information recording layer 2 as the reference beam for record is generated. The playback light in this case is an emission light which serves as a minor diameter most by the near side of the information recording layer 2. If it explains in more detail, in the field in the upper half of a record section 260, the playback light corresponding to the light which the light of B polarization from rotatory-polarization plate 214AR was irradiated, and was irradiated from rotatory-polarization plate 214BR of 2 division rotatory-polarization plate 214B at the time of record will be generated. This playback light is the light of B polarization, it is condensed by objective lens 212A, and passes rotatory-polarization plate 214AL of 2 division rotatory-polarization plate 214A, and turns into light of S polarization. Similarly, in the field in the lower half of a record section 260, the playback light corresponding to the light which the light of A polarization from rotatory-polarization plate 214AL was irradiated, and was irradiated from rotatory-polarization plate 214BL of 2 division rotatory-polarization plate 214B at the time of record is generated. This playback light is the light of A polarization, it is condensed by objective lens 212A, and passes rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A, and turns into light of S polarization. It is reflected by polarization beam splitter side 315Aa of prism block 315A, it is condensed by convex lens 318A, and image formation of the playback light of these S polarization is carried out on CCD array 219A. Thus, on CCD array 219A, in the space optical modulator 216, only the part corresponding to the pixel which was ON is brightly irradiated at the time of record, the two-dimensional pattern is detected by CCD array 219A, and informational playback is performed.
[0178] On the other hand, when all the pixels of the space optical modulator 216 are in the condition of ON, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 217, and serves as as [S polarization], without the polarization direction rotating with the space optical modulator 216. It is reflected by polarization beam splitter side 315Aa of prism block 315A, and is further reflected by reflector 315Ab, and incidence is carried out to prism block 315B, it is reflected in order by reflector 315Bb and polarization beam splitter side 315Ba, and incidence of the light of S polarization from the space optical modulator 216 is carried out to 2 division rotatory-polarization plate 214B. Here,

since both rotatory-polarization plate 214BR of 2 division rotatory-polarization plate 214B and 214BL are turned OFF, the polarization direction rotates +45 degrees of light which the polarization direction rotated -45 degrees of light which passed rotatory-polarization plate 214BR, turned into B polarization, and passed rotatory-polarization plate 214BL, and it becomes A polarization. The light from 2 division rotatory-polarization plate 214B is the front face of the transparence substrate 3, and it is converged so that it may become a minor diameter most.

[0179] From the record section 260 in the information recording layer 2, the playback light at the time of regarding the light from 2 division rotatory-polarization plate 214B as the reference beam for playback is generated. If it explains in more detail, in the field in the upper half of a record section 260, the playback light corresponding to the light which the light of B polarization from rotatory-polarization plate 214BR was irradiated, and was irradiated from rotatory-polarization plate 214AR of 2 division rotatory-polarization plate 214A at the time of record will be generated. This playback light is the light of B polarization, it is condensed by objective lens 212B, and passes rotatory-polarization plate 214BL of 2 division rotatory-polarization plate 214B, and turns into light of P polarization. Similarly, in the field in the lower half of a record section 260, the playback light corresponding to the light which the light of A polarization from rotatory-polarization plate 214BL was irradiated, and was irradiated from rotatory-polarization plate 214AL of 2 division rotatory-polarization plate 214A at the time of record is generated. This playback light is the light of A polarization, it is condensed by objective lens 212B, and passes rotatory-polarization plate 214BR of 2 division rotatory-polarization plate 214B, and turns into light of P polarization. Polarization beam splitter side 315Ba of prism block 315B is penetrated, it is condensed by convex lens 318B, and image formation of the playback light of these P polarization is carried out on CCD array 219B. Thus, on CCD array 219B, in the space optical modulator 216, only the part corresponding to the off pixel is brightly irradiated at the time of record, the two-dimensional pattern is detected by CCD array 219B, and informational playback is performed.

[0180] With the gestalt of this operation, like the gestalt of the 3rd operation, all the pixels of the space optical modulator 216 may reproduce information as an off condition, and all the pixels of the space optical modulator 216 may reproduce information as a condition of ON.

[0181] The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 3rd operation.

[0182] In addition, in the gestalt of the 3rd and the 4th operation, ultraviolet rays may be used as a light for fixing. In this case, a photopolymer is used for the information recording layer 2. The informational record and informational fixing in the information recording layer 2 advance as follows. That is, the photopolymer which constitutes the information recording layer 2 distributes a photopolymerization nature monomer in a binder polymer. If an interference pattern is formed in this information recording layer 2, the polymerization of a photopolymerization nature monomer will progress in the bright section of an interference pattern, the concentration gradient of a monomer will arise, and a monomer will be spread to the part which progressed from the part to which the polymerization is not progressing. Consequently, the polymer part to which the polymerization progressed, and the part whose rate of a binder polymer the monomer decreased and increased arise, refractive-index distribution arises, and information is recorded by this refractive-index distribution. In this condition, when ultraviolet rays are irradiated, the polymerization of an unreacted monomer will be completed and record will be established.

[0183] Next, the gestalt of operation of the 5th of this invention is explained. The whole optical information record regenerative-apparatus configuration concerning the gestalt of this operation is the same as that of drawing 5 except for the point that the configurations of pickup differ.

[0184] Drawing 24 is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of this operation. In addition, the same sign is hereafter given to the same member as the member under pickup shown in drawing 1 , and detailed explanation is omitted. The optical information record medium 401 used with the optical information record regenerative apparatus concerning the gestalt of this operation has the composition of having formed the transparent protective layer 402,402 in the both sides of the information recording layer 2.

[0185] The pickup 411 in the gestalt of this operation The objective lens 412 arranged so that one

field of the optical information record medium 401 may be countered when the optical information record medium 401 is fixed to a spindle 81, The mirror 418 arranged in the objective lens 412 and the location which counters on both sides of the optical information record medium 401, It has the space optical modulator 413, the beam splitter 414, and the CCD array 19 which were arranged in the opposite side sequentially from the objective lens 412 side in the optical information record medium 401 in an objective lens 412. Pickup 411 is further equipped with the collimator lens 415 and the laser coupler 20 which were arranged in the side of a beam splitter 414.

[0186] The objective lens 412 is arranged so that the optical axis may make the include angle of 60 degrees to the field of the optical information record medium 401. The beam splitter 414 has semi-reflection surface 414a by which the 45 degrees of the direction of a normal were leaned, and it has been arranged to the direction of an optical axis of an objective lens 412. And a part of quantity of light is reflected by semi-reflection surface 414a, incidence of the light which carries out incidence to a beam splitter 414 from the laser coupler 20 side is carried out to the space optical modulator 413, and a part of quantity of light penetrates semi-reflection surface 414a.

[0187] The space optical modulator 413 has the pixel of a large number arranged in the shape of a grid, and can modulate light now spatially with optical reinforcement by choosing the transparency condition and cut off state of light for every pixel.

[0188] The prism 416 which carries out incidence of the pickup 411 to a beam splitter 414 more nearly further than the laser coupler 20 side, is arranged in the travelling direction of the light which penetrates semi-reflection surface 414a, and has total reflection side 416a parallel to semi-reflection surface 1414a, The prism 417 which has total reflection side 417a which is arranged in the travelling direction of light reflected by total reflection side 416a of this prism 416, and intersects perpendicularly with total reflection side 416a, It has the convex lens 53, the concave lens 54, and cylindrical lens 55 which were arranged in the travelling direction of light reflected by total reflection side 417a in order [side / prism 417]. The light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the information recording layer 2 so that the core (optical axis) of the light in which outgoing radiation is carried out by the objective lens 412 into the information recording layer 2, and the core (optical axis) may cross at right angles. Therefore, the light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the optical information record medium 401 so that the include angle of 30 degrees may be made to the field of the optical information record medium 401. Moreover, the light by which outgoing radiation is carried out from a cylindrical lens 55 becomes the thinnest within the information recording layer 2.

[0189] In the pickup 411 in the gestalt of this operation, it considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation is carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. The space optical modulator 413 is passed, it is condensed with an objective lens 412, and the light reflected by semi-reflection surface 414a is irradiated by the optical information record medium 401. This light is converged so that it may become a minor diameter most on the field of a mirror 418.

[0190] On the other hand, it is reflected in order by total reflection side 416a of prism 416, and total reflection side 417a of prism 417, the light which penetrated semi-reflection surface 414a passes a convex lens 53 and a concave lens 54 in order, and the path of the flux of light is reduced. It is completed by the cylindrical lens 55 only about the direction of an optical axis of an objective lens 412, and outgoing radiation light of a concave lens 54 is made the flux of light of a flat configuration, and is irradiated by the optical information record medium 401 by it. The light from an objective lens 412 side and the light from a cylindrical-lens 55 side cross within the information recording layer 2 so that the core of each light may intersect perpendicularly.

[0191] At the time of informational record, the light from an objective lens 412 side turns into information light, the light from a cylindrical-lens 55 side turns into a reference beam for record, and the record section 420 where information is recorded with the interference pattern by interference with such information light and the reference beam for record is formed in the shape of a layer in the information recording layer 2. With the gestalt of this operation, as shown in drawing 24 , within the information recording layer 2, the part of the left half in drawing of the light from an objective lens

412 side and the light of the flat configuration from a cylindrical-lens 55 side cross. Therefore, the configuration of the record section 420 formed in the information recording layer 2 turns into tabular [of a hemicycle].

[0192] The light which goes to an objective lens 412 side from the optical information record medium 401 passes an objective lens 412 and the space optical modulator 413 in order, a part of quantity of light penetrates semi-reflection surface 414a of a beam splitter 414, and it carries out incidence of it to the CCD array 19.

[0193] Next, an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained. It is possible to form both the hologram of a transparency mold and the hologram of a reflective mold in the information recording layer 2 of the optical information record medium 401 in the optical information record regenerative apparatus concerning the gestalt of this operation.

[0194] The case where the hologram of a transparency mold is formed in introduction and the information recording layer 2 is explained. In this case, at the time of record, all pixels are made into a cut off state, and a transparency condition and a cut off state are chosen for every pixel at field 413R of the right half in drawing of the space optical modulator 413 according to the information to record by field 413L of a left half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse.

[0195] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. Incidence of the light reflected by semi-reflection surface 414a is carried out to the space optical modulator 413, and outgoing radiation of the light modulated from field 413L of a left half according to the information to record is carried out. Let this light be information light. It is condensed with an objective lens 412 and this information light is irradiated by the optical information record medium 401.

[0196] On the other hand, it is reflected in order by total reflection side 416a of prism 416, and total reflection side 417a of prism 417, and the light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 401. Let this light be a reference beam for record.

[0197] The information light from an objective lens 412 side and the reference beam for record from a cylindrical-lens 55 side cross within the information recording layer 2 so that the core of each light may intersect perpendicularly. And when the interference pattern by interference of such light is formed in the part which such information light and the reference beam for record intersect and the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern by information light and the reference beam for record is recorded in volume in the information recording layer 2, and the record section 420 which consists of a volume hologram of a transparency mold is formed in the shape of a layer.

[0198] At the time of playback, all pixels are made into a transparency condition in field 413R in the right half of the space optical modulator 413, and all pixels are made into a cut off state by field 413L of a left half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for record.

[0199] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. It is reflected in order by total reflection side 416a of prism 416, and total reflection side 417a of prism 417, and the light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 401. Let this light be a reference beam for playback. If this reference beam for playback is irradiated by the record section 420 in the information recording layer 2, the playback light corresponding to the information light at the time of record will be generated from a record section 420. It goes on to an objective lens 412 side, being reflected by the mirror 418 and

spread, while converging so that it may become a minor diameter most on a mirror 418, and with an objective lens 412, this playback light passes field 413R in the right half of the space optical modulator 413, it goes on to a mirror 418 side, converging, and it carries out [it considers as the parallel flux of light, and / a part of quantity of light penetrates semi-reflection surface 414a of a beam splitter 414, and] incidence of it to the CCD array 19. And informational playback is performed by detecting the two-dimensional pattern of playback light by the CCD array 19.

[0200] In addition, although the laser beam by which outgoing radiation was carried out from the laser coupler 20 passes field 413R in the right half of the space optical modulator 413 and is irradiated by the optical information record medium 401 at the time of playback, after it is reflected by the mirror 418 and this light passes an objective lens 412, it is intercepted by field 413L in the left half of the space optical modulator 413.

[0201] Next, in the gestalt of this operation, the case where the hologram of a reflective mold is formed in the information recording layer 2 is explained. In this case, at the time of record, all pixels are made into a cut off state, and a transparency condition and a cut off state are chosen for every pixel at field 413L in the left half of the space optical modulator 413 according to the information to record by field 413R of a right half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse.

[0202] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. Incidence of the light reflected by semi-reflection surface 414a is carried out to the space optical modulator 413, and outgoing radiation of the light modulated from field 413R of a right half according to the information to record is carried out. It is condensed with an objective lens 412, and this light is irradiated by the optical information record medium 401, and passes the optical information record medium 401, and it carries out incidence to the optical information record medium 401 again, being reflected by the mirror 418 and spread, while converging so that it may become a minor diameter most on a mirror 418. Let this light be information light.

[0203] On the other hand, it is reflected in order by total reflection side 416a of prism 416, and total reflection side 417a of prism 417, and the light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 401. Let this light be a reference beam for record.

[0204] The information light from a mirror 418 side and the reference beam for record from a cylindrical-lens 55 side cross within the information recording layer 2 so that the core of each light may intersect perpendicularly. And when the interference pattern by interference of such light is formed in the part which such information light and the reference beam for record intersect and the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern by information light and the reference beam for record is recorded in volume in the information recording layer 2, and the record section 420 which consists of a volume hologram of a reflective mold is formed in the shape of a layer.

[0205] At the time of playback, all pixels are made into a transparency condition in field 413L in the left half of the space optical modulator 413, and all pixels are made into a cut off state by field 413R of a right half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for record.

[0206] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. It is reflected in order by total reflection side 416a of prism 416, and total reflection side 417a of prism 417, and the light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 401. Let this light be a reference beam for playback. If this reference beam for playback is irradiated by the record section 420 in the information recording layer 2, the

playback light corresponding to the information light at the time of record will be generated from a record section 420. It goes on to an objective lens 412 side, being spread, and with an objective lens 412, this playback light passes field 413L in the left half of the space optical modulator 413, it considers as the parallel flux of light, and it carries out [a part of quantity of light penetrates semi-reflection surface 414a of a beam splitter 414, and] incidence of it to the CCD array 19. And informational playback is performed by detecting the two-dimensional pattern of playback light by the CCD array 19.

[0207] In addition, although the laser beam by which outgoing radiation was carried out from the laser coupler 20 passes field 413L in the left half of the space optical modulator 413 and is irradiated by the optical information record medium 401 at the time of playback, after it is reflected by the mirror 418 and this light passes an objective lens 412, it is intercepted by field 413R in the right half of the space optical modulator 413.

[0208] The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 1st operation.

[0209] Next, the gestalt of operation of the 6th of this invention is explained. The whole optical information record regenerative-apparatus configuration concerning the gestalt of this operation is the same as that of drawing 5 except for the point that the configurations of pickup differ.

[0210] Drawing 25 is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of this operation. In addition, the same sign is hereafter given to the same member as the member under pickup shown in drawing 24 , and detailed explanation is omitted. The optical information record medium 501 used with the optical information record regenerative apparatus concerning the gestalt of this operation has the composition of having formed the transparence substrate 502 in one both sides of the information recording layer 2, and having formed the transparent protective layer 503 in the field side of another side. The field of the outside of the transparence substrate 502 is a reflector 504.

[0211] The objective lens 412 with which the pickup 511 in the gestalt of this operation has been arranged so that one field of the optical information record medium 501 may be countered when the optical information record medium 501 is fixed to a spindle 81, and the optical information record medium 501 in an objective lens 412 are equipped with the space optical modulator 413, the beam splitter 414, and the CCD array 19 which were arranged in the opposite side sequentially from the objective lens 412 side. Pickup 511 is further equipped with the collimator lens 415 and the laser coupler 20 which were arranged in the side of a beam splitter 414. With the gestalt of this operation, the objective lens 412 is arranged so that the optical axis may become perpendicular to the field of the optical information record medium 501.

[0212] Further, pickup 411 carried out incidence to the beam splitter 414 from the laser coupler 20 side, and is equipped with the mirror 512 arranged in the travelling direction of the light which penetrates semi-reflection surface 414a, and the convex lens 53, the concave lens 54 and cylindrical lens 55 which were arranged in the travelling direction of light reflected by this mirror 512 in order [side / mirror 512]. With the gestalt of this operation, the light by which outgoing radiation is carried out from a cylindrical lens 55 is irradiated to the optical information record medium 501, and intersects the light from an objective lens 412 side in the information recording layer 2 so that the core (optical axis) may make the include angle of 45 degrees to the field of the optical information record medium 501. Moreover, the light by which outgoing radiation is carried out from a cylindrical lens 55 becomes the thinnest within the information recording layer 2.

[0213] In the pickup 511 in the gestalt of this operation, it considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation is carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. The space optical modulator 413 is passed, it is condensed with an objective lens 412, and the light reflected by semi-reflection surface 414a is irradiated by the optical information record medium 501. This light is converged so that it may become a minor diameter most on the reflector 504 of the information record medium 501.

[0214] On the other hand, it is reflected by the mirror 512, the light which penetrated semi-reflection surface 414a passes a convex lens 53 and a concave lens 54 in order, and the path of the flux of light

is reduced. By the cylindrical lens 55, outgoing radiation light of a concave lens 54 is made into the flux of light of a flat configuration, is irradiated by the optical information record medium 501, and intersects the light from an objective lens 412 side within the information recording layer 2.
[0215] At the time of informational record, the light from an objective lens 412 side turns into information light, the light from a cylindrical-lens 55 side turns into a reference beam for record, and the record section 520 where information is recorded with the interference pattern by interference with such information light and the reference beam for record is formed in the shape of a layer in the information recording layer 2. With the gestalt of this operation, as shown in drawing 25 , within the information recording layer 2, the part of the right half in drawing of the light from an objective lens 412 side and the light of the flat configuration from a cylindrical-lens 55 side cross. Therefore, the configuration of the record section 420 formed in the information recording layer 2 turns into tabular [of a hemicycle].
[0216] The light which goes to an objective lens 412 side from the optical information record medium 501 passes an objective lens 412 and the space optical modulator 413 in order, a part of quantity of light penetrates semi-reflection surface 414a of a beam splitter 414, and it carries out incidence of it to the CCD array 19.
[0217] Next, an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained. It is possible to form both the hologram of a transparency mold and the hologram of a reflective mold in the information recording layer 2 of the optical information record medium 501 in the optical information record regenerative apparatus concerning the gestalt of this operation.
[0218] The case where the hologram of a transparency mold is formed in introduction and the information recording layer 2 is explained. In this case, at the time of record, all pixels are made into a cut off state, and a transparency condition and a cut off state are chosen for every pixel at field 413L of the left half in drawing of the space optical modulator 413 according to the information to record by field 413R of a right half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse.
[0219] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. Incidence of the light reflected by semi-reflection surface 414a is carried out to the space optical modulator 413, and outgoing radiation of the light modulated from field 413R of a right half according to the information to record is carried out. Let this light be information light. It is condensed with an objective lens 412 and this information light is irradiated by the optical information record medium 501.
[0220] On the other hand, it is reflected by the mirror 512, and the light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 501. Let this light be a reference beam for record.
[0221] The information light from an objective lens 412 side and the reference beam for record from a cylindrical-lens 55 side cross within the information recording layer 2. And when the interference pattern by interference of such light is formed in the part which such information light and the reference beam for record intersect and the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern by information light and the reference beam for record is recorded in volume in the information recording layer 2, and the record section 520 which consists of a volume hologram of a transparency mold is formed in the shape of a layer.
[0222] At the time of playback, all pixels are made into a cut off state in field 413R in the right half of the space optical modulator 413, and all pixels are made into a transparency condition by field 413L of a left half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for record.
[0223] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. It is reflected by the mirror 512, and the

light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 501. Let this light be a reference beam for playback. If this reference beam for playback is irradiated by the record section 520 in the information recording layer 2, the playback light corresponding to the information light at the time of record will be generated from a record section 520. It goes on to an objective lens 412 side, being reflected in a reflector 504 and spread, while converging so that it may become a minor diameter most on a reflector 504, and with an objective lens 412, this playback light passes field 413L in the left half of the space optical modulator 413, it goes on to a reflector 504 side, converging, and it carries out [it considers as the parallel flux of light, and / a part of quantity of light penetrates semi-reflection surface 414a of a beam splitter 414, and] incidence of it to the CCD array 19. And informational playback is performed by detecting the two-dimensional pattern of playback light by the CCD array 19.

[0224] In addition, although the laser beam by which outgoing radiation was carried out from the laser coupler 20 passes field 413L in the left half of the space optical modulator 413 and is irradiated by the optical information record medium 501 at the time of playback, after it is reflected in a reflector 504 and this light passes an objective lens 412, it is intercepted by field 413R in the right half of the space optical modulator 413.

[0225] Next, in the gestalt of this operation, the case where the hologram of a reflective mold is formed in the information recording layer 2 is explained. In this case, at the time of record, all pixels are made into a cut off state, and a transparency condition and a cut off state are chosen for every pixel at field 413R in the right half of the space optical modulator 413 according to the information to record by field 413L of a left half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse.

[0226] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. Incidence of the light reflected by semi-reflection surface 414a is carried out to the space optical modulator 413, and outgoing radiation of the light modulated from field 413L of a left half according to the information to record is carried out. It is condensed with an objective lens 412, and this light is irradiated by the optical information record medium 501, and passes the information recording layer 2, and it carries out incidence to the information recording layer 2 again, being reflected in a reflector 504 and spread, while converging so that it may become a minor diameter most on a reflector 504. Let this light be information light.

[0227] On the other hand, it is reflected by the mirror 512, and the light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 501. Let this light be a reference beam for record.

[0228] The information light from a reflector 504 side and the reference beam for record from a cylindrical-lens 55 side cross within the information recording layer 2. And when the interference pattern by interference of such light is formed in the part which such information light and the reference beam for record intersect and the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern by information light and the reference beam for record is recorded in volume in the information recording layer 2, and the record section 520 which consists of a volume hologram of a reflective mold is formed in the shape of a layer.

[0229] At the time of playback, all pixels are made into a transparency condition in field 413R in the right half of the space optical modulator 413, and all pixels are made into a cut off state by field 413L of a left half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for record.

[0230] It considers as the parallel flux of light, incidence is carried out to a beam splitter 414, a part of quantity of light is reflected by the collimator lens 415 by semi-reflection surface 414a, and a part of quantity of light of the laser beam by which outgoing radiation was carried out from the laser coupler 20 penetrates semi-reflection surface 414a by it. It is reflected by the mirror 512, and the light which penetrated semi-reflection surface 414a passes a convex lens 53, a concave lens 54, and a

cylindrical lens 55 in order, is made into the flux of light of a flat configuration, and is irradiated by the optical information record medium 501. Let this light be a reference beam for playback. If this reference beam for playback is irradiated by the record section 520 in the information recording layer 2, the playback light corresponding to the information light at the time of record will be generated from a record section 520. It goes on to an objective lens 412 side, being spread, and with an objective lens 412, this playback light passes field 413R in the right half of the space optical modulator 413, it considers as the parallel flux of light, and it carries out [a part of quantity of light penetrates semi-reflection surface 414a of a beam splitter 414, and] incidence of it to the CCD array 19. And informational playback is performed by detecting the two-dimensional pattern of playback light by the CCD array 19.

[0231] In addition, although the laser beam by which outgoing radiation was carried out from the laser coupler 20 passes field 413R in the right half of the space optical modulator 413 and is irradiated by the optical information record medium 501 at the time of playback, after it is reflected in a reflector 504 and this light passes an objective lens 412, it is intercepted by field 413L in the left half of the space optical modulator 413.

[0232] The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 5th operation.

[0233] In addition, although this invention formed two or more record sections, without not having been limited to the gestalt of each above-mentioned implementation, for example, lapping mutually in the information recording layer 2 with the gestalt of each operation, it may be made to carry out multiplex record of the information for every record section so that a part of adjoining record sections may lap within disengageable limits.

[0234] Moreover, although it was made to become irregular by a difference and luminous intensity of polarization with the gestalt of each operation when the flux of light was modulated according to the information to record, you may make it become irregular by phase contrast etc.

[0235] Moreover, although the flux of light of the reference beam for record of information light and the reference beams for record was made into the flat configuration with the 1st, the 2nd, the 5th, and the gestalt of each 6th operation, it is good also considering the flux of light of information light as a flat configuration.

[0236] Moreover, the shape of the shape not only of disc-like but a card and a tape etc. has as the gestalt of an optical information record medium.

[0237]

[Effect of the Invention] As explained above, according to an optical information recording device according to claim 1 to 6 or the optical information record approach according to claim 12 Make one flux of light of information light and the reference beams for record into a flat configuration, and information light and the reference beam for record are irradiated to an information recording layer so that it may cross within an information recording layer. Since the record section where information is recorded in an information recording layer with the interference pattern by interference with information light and the reference beam for record was formed in the shape of a layer The effectiveness of becoming possible to record information on high density more to the optical information record medium with which information is recorded using holography is done so.

[0238] According to the optical information recording device according to claim 3, moreover, as an optical information record medium The thing equipped with the positioning field where the information for positioning of information light and the reference beam for record is recorded is used. Since the location of the information light to an optical information record medium and the reference beam for record was controlled using the information recorded on the positioning field, the effectiveness that light for record can be positioned with a sufficient precision is further done so.

[0239] Moreover, since it was made to have the solid emersion lens which record optical system is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass according to the optical information recording device according to claim 6, the effectiveness that the aberration of information light and the reference beam for record can be reduced is further done so.

[0240] According to an optical information recording device according to claim 7 to 11 or the optical information record approach according to claim 13 So that the interference pattern by interference

with information light and the reference beam for record may be formed in an information recording layer As opposed to the field where information light and the reference beam for record were irradiated to the information recording layer, and the interference pattern was formed in the information recording layer It irradiates so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established. Since the record section where information was recorded with the interference pattern in the information recording layer, and it was fixed to information was formed in the shape of a layer While becoming possible to record information on high density more to the optical information record medium with which information is recorded using holography, the effectiveness that information can be recorded at any time and it can be established to an optical information record medium is done so.

[0241] According to the optical information recording device according to claim 9, moreover, as an optical information record medium The thing equipped with the positioning field where the information for positioning of information light and the reference beam for record is recorded is used. Since the location of the information light to an optical information record medium and the reference beam for record was controlled using the information recorded on the positioning field, the effectiveness that light for record can be positioned with a sufficient precision is further done so.

[0242] Moreover, since it was made to have the solid emersion lens which record optical system is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass according to the optical information recording device according to claim 11, the effectiveness that the aberration of information light and the reference beam for record can be reduced is further done so.

[0243] According to an optical information record regenerative apparatus according to claim 14 to 17 or the optical information record playback approach according to claim 22, at the time of informational record Make one flux of light of information light and the reference beams for record into a flat configuration, and information light and the reference beam for record are irradiated to an information recording layer so that it may cross within an information recording layer. The record section where information is recorded in an information recording layer with the interference pattern by interference with information light and the reference beam for record is formed in the shape of a layer. At the time of informational playback Since the reference beam for playback corresponding to the reference beam for record at the time of record is irradiated, the playback light generated from an information recording layer is collected to an information recording layer and it was made to detect to it The effectiveness of becoming possible to reproduce appropriately the information which recorded information on high density more, and was recorded on the optical information record medium to the optical information record medium with which information is recorded using holography is done so.

[0244] According to the optical information record regenerative apparatus according to claim 16, moreover, as an optical information record medium The thing equipped with the positioning field where the information for positioning of information light, the reference beam for record, and the reference beam for playback is recorded is used. Since the location of the information light to an optical information record medium, the reference beam for record, and the reference beam for playback was controlled using the information recorded on the positioning field, the effectiveness that light for record and playback can be positioned with a sufficient precision is further done so.

[0245] According to the optical information record regenerative apparatus according to claim 17, moreover, record optical system It has the solid emersion lens which it is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass. Since it was made to have the solid emersion lens which playback optical system is arranged so that an optical information record medium may be countered, and playback light passes, the effectiveness that the aberration of information light, the reference beam for record, and playback light can be reduced is further done so.

[0246] According to an optical information record regenerative apparatus according to claim 18 to 21 or the optical information record playback approach according to claim 23, at the time of informational record So that the interference pattern by interference with information light and the reference beam for record may be formed in an information recording layer As opposed to the field

where information light and the reference beam for record were irradiated to the information recording layer, and the interference pattern was formed in the information recording layer It irradiates so that it may pass through a part of field in which the interference pattern was formed in the light for fixing of the flux of light of the flat configuration for the information recorded with an interference pattern being established. The record section where information was recorded with the interference pattern in the information recording layer, and it was fixed to information is formed in the shape of a layer. At the time of informational playback Since the reference beam for playback corresponding to the reference beam for record at the time of record is irradiated, the playback light generated from an information recording layer is collected to an information recording layer and it was made to detect to it While becoming possible to record information on high density more to the optical information record medium with which information is recorded using holography The effectiveness of becoming possible to reproduce appropriately the information which could record information at any time, could be established to the optical information record medium, and was recorded on the optical information record medium is done so.

[0247] According to the optical information record regenerative apparatus according to claim 20, moreover, as an optical information record medium The thing equipped with the positioning field where the information for positioning of information light, the reference beam for record, and the reference beam for playback is recorded is used. Since the location of the information light to an optical information record medium, the reference beam for record, and the reference beam for playback was controlled using the information recorded on the positioning field, the effectiveness that light for record and playback can be positioned with a sufficient precision is further done so.

[0248] According to the optical information record regenerative apparatus according to claim 21, moreover, record optical system It has the solid emersion lens which it is arranged so that an optical information record medium may be countered, and information light and the reference beam for record pass. Since it was made to have the solid emersion lens which playback optical system is arranged so that an optical information record medium may be countered, and playback light passes, the effectiveness that the aberration of information light, the reference beam for record, and playback light can be reduced is further done so.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view showing the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 1st of this invention, and the configuration of an optical information record medium.
[Drawing 2] It is an explanatory view for explaining SIL in drawing 1 in detail.
[Drawing 3] It is the sectional view showing an example of the support device of SIL in drawing 1 .
[Drawing 4] It is the side elevation showing other examples of the support device of SIL in drawing 1 .
[Drawing 5] It is the block diagram showing the whole optical information record regenerative-apparatus configuration concerning the gestalt of operation of the 1st of this invention.
[Drawing 6] It is the perspective view showing the configuration of the laser coupler in drawing 1 .
[Drawing 7] It is the side elevation of the laser coupler in drawing 1 .
[Drawing 8] It is the block diagram showing the configuration of the detector in drawing 5 .
[Drawing 9] It is the explanatory view showing the record section formed in the information recording layer of an optical information record medium in the gestalt of operation of the 1st of this invention.
[Drawing 10] It is the explanatory view showing the record section formed in the information recording layer of an optical information record medium in the gestalt of operation of the 1st of this invention.
[Drawing 11] It is an explanatory view for explaining how to recognize the criteria location in the pattern of playback light from the detection data of the CCD array in drawing 1 .
[Drawing 12] It is an explanatory view for explaining how to recognize the criteria location in the pattern of playback light from the detection data of the CCD array in drawing 1 .
[Drawing 13] It is the explanatory view showing the pattern of information light and the pattern of playback light in the pickup shown in drawing 1 .
[Drawing 14] It is the explanatory view showing the contents of the data distinguished from the pattern of the playback light detected by the pickup shown in drawing 1 , and the ECC table corresponding to this data.
[Drawing 15] It is the explanatory view showing notionally the optical information record medium which recorded the hologram showing address information etc. on address servo area.
[Drawing 16] It is the explanatory view showing the configuration of the pickup in the modification of the gestalt of operation of the 1st of this invention.
[Drawing 17] It is the explanatory view showing the configuration of the pickup in other modifications of the gestalt of operation of the 1st of this invention.
[Drawing 18] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 2nd of this invention.
[Drawing 19] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 3rd of this invention.
[Drawing 20] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 3rd of this

invention.
[Drawing 21] It is an explanatory view for explaining the polarization used in the gestalt of operation of the 3rd of this invention.
[Drawing 22] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 4th of this invention.
[Drawing 23] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 4th of this invention.
[Drawing 24] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 5th of this invention.
[Drawing 25] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 6th of this invention.
[Drawing 26] It is the perspective view showing the configuration of the outline of the record reversion system in the conventional digital volume holography.
[Description of Notations]
1 [-- An optical information record regenerative apparatus, 11 / -- Pickup, 12A, 12 B--SIL, 13A, 13B / -- An objective lens, 14A, 14B / -- An actuator, 15 / -- A space optical modulator, 19 / -- A CCD array, 20 / -- Laser coupler.] -- An optical information record medium, 2 -- An information recording layer, 3 -- A positioning layer, 10

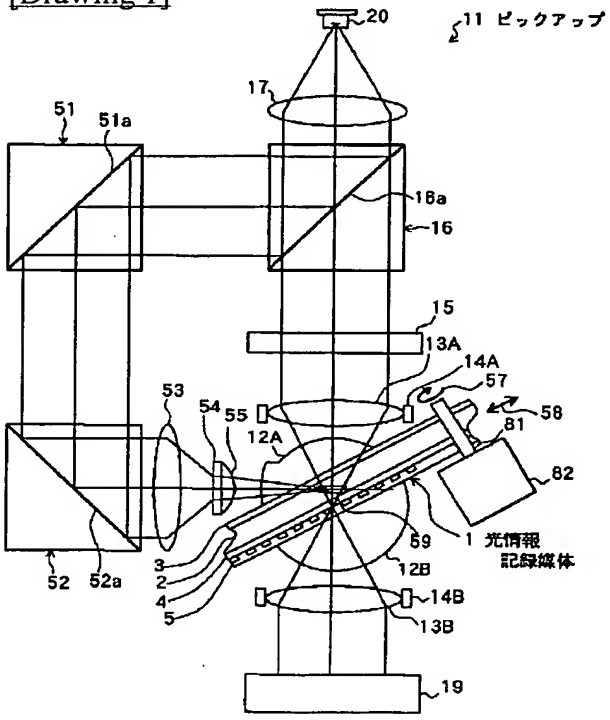
[Translation done.]

* NOTICES *

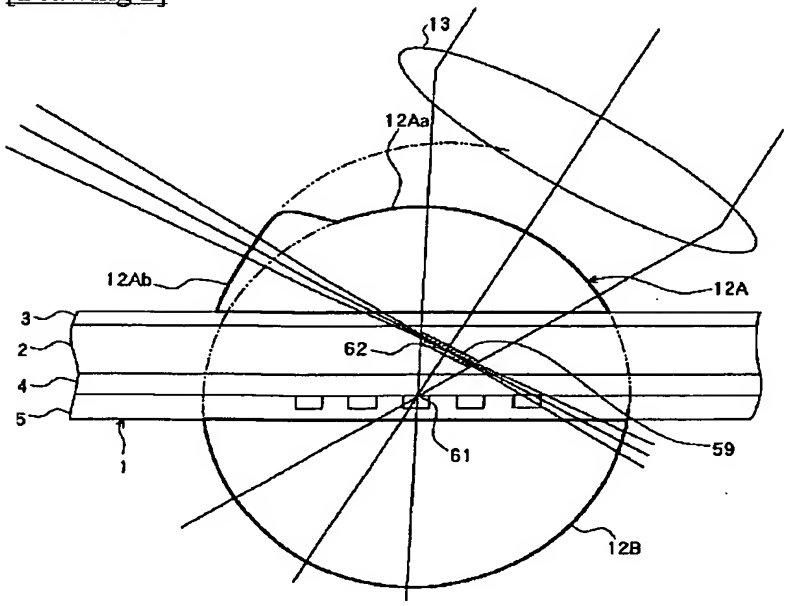
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

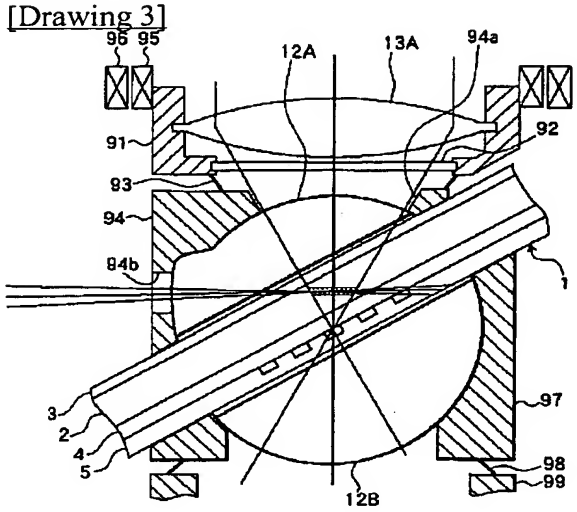
[Drawing 1]



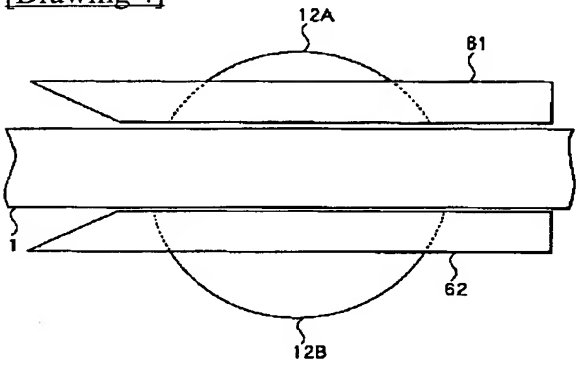
[Drawing 2]



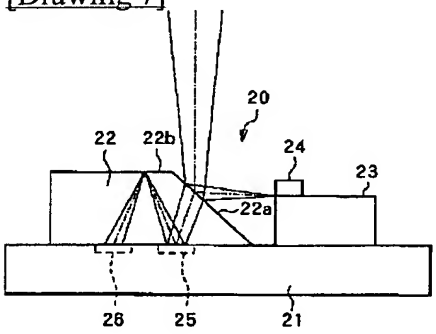
[Drawing 3]



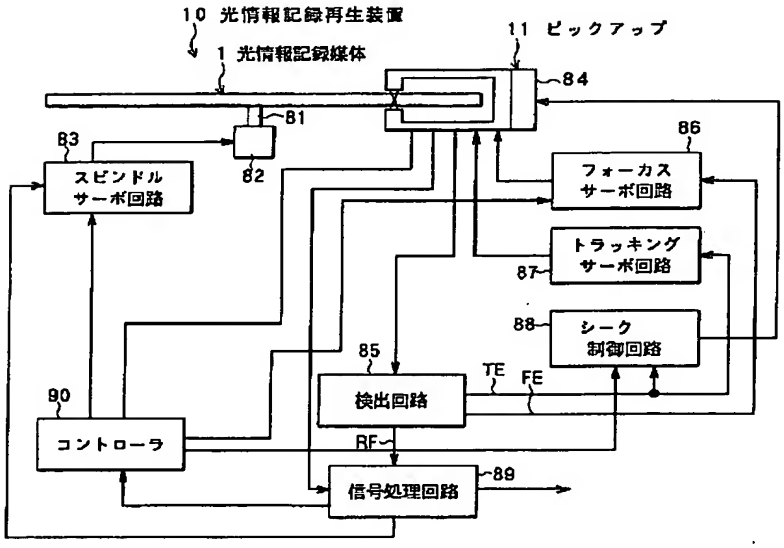
[Drawing 4]



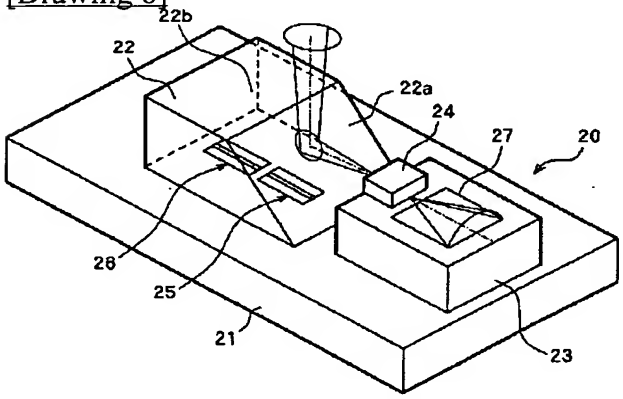
[Drawing 7]



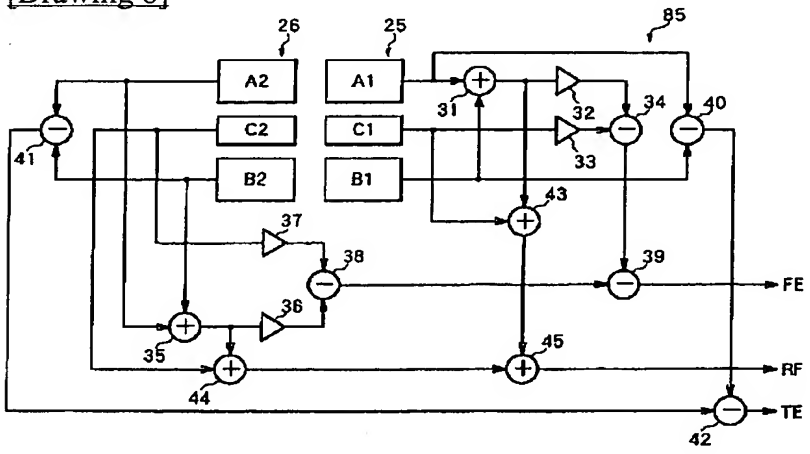
[Drawing 5]



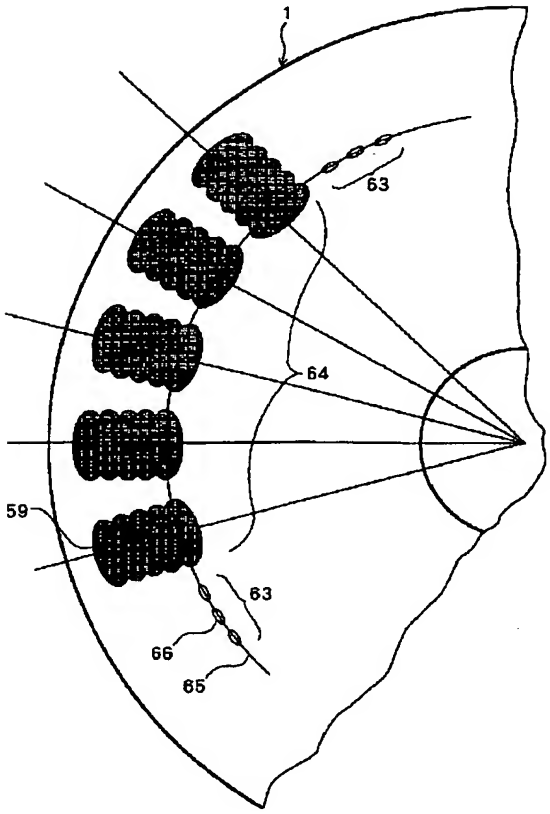
[Drawing 6]



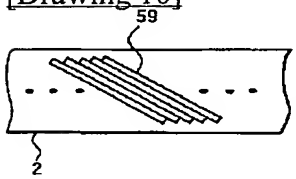
[Drawing 8]



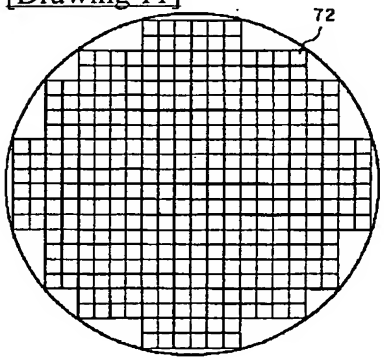
[Drawing 9]



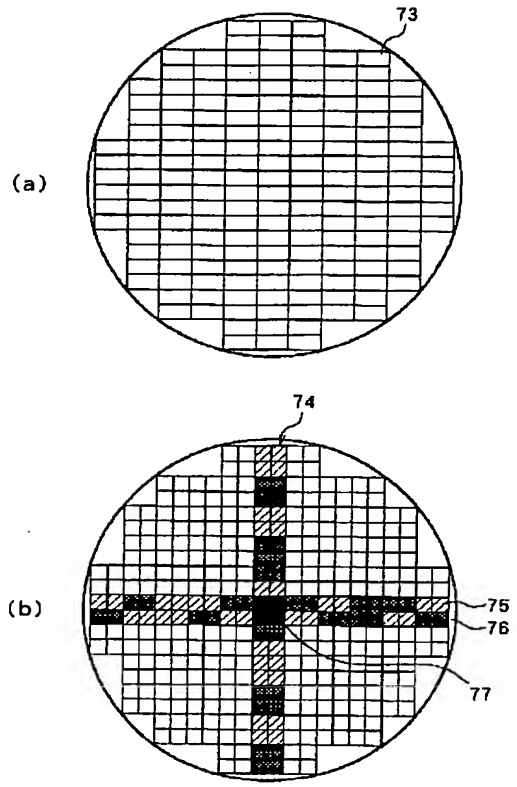
[Drawing 10]



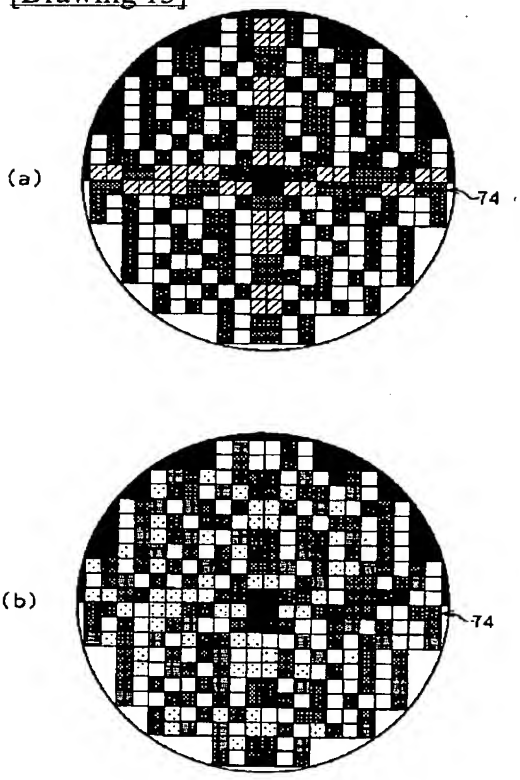
[Drawing 11]



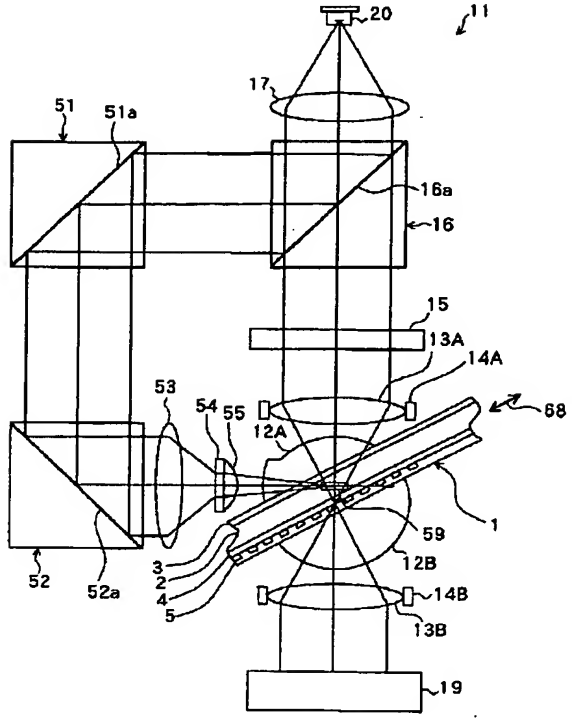
[Drawing 12]



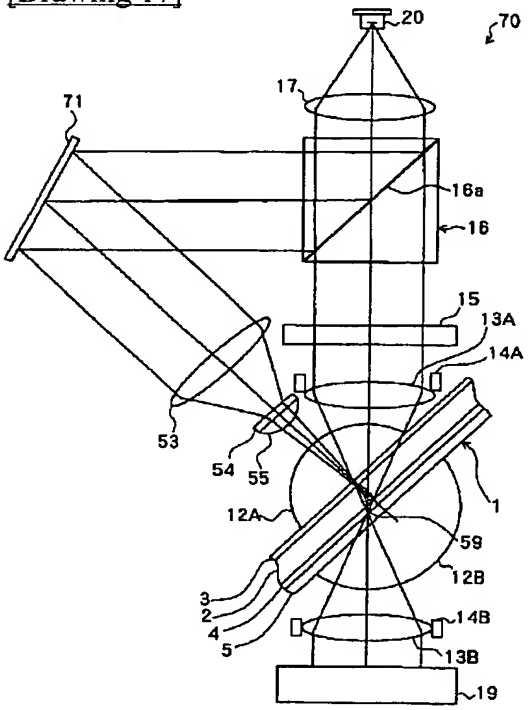
[Drawing 13]



[Drawing 16]



[Drawing 17]



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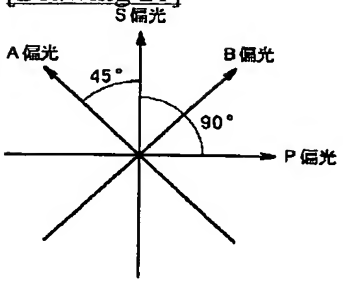
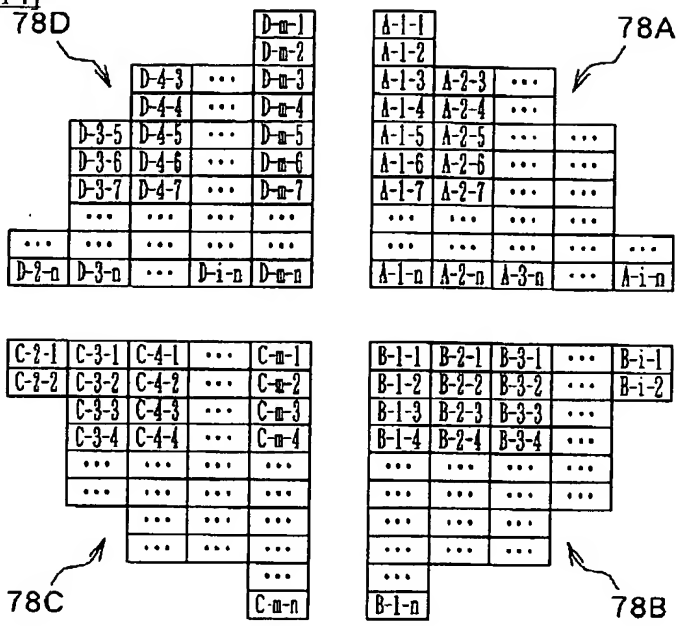
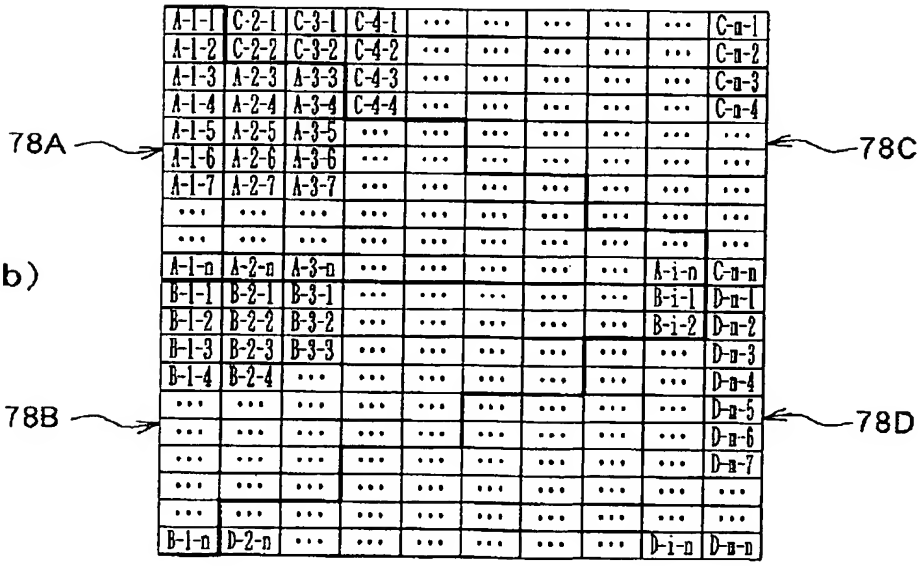


[Drawing 14]

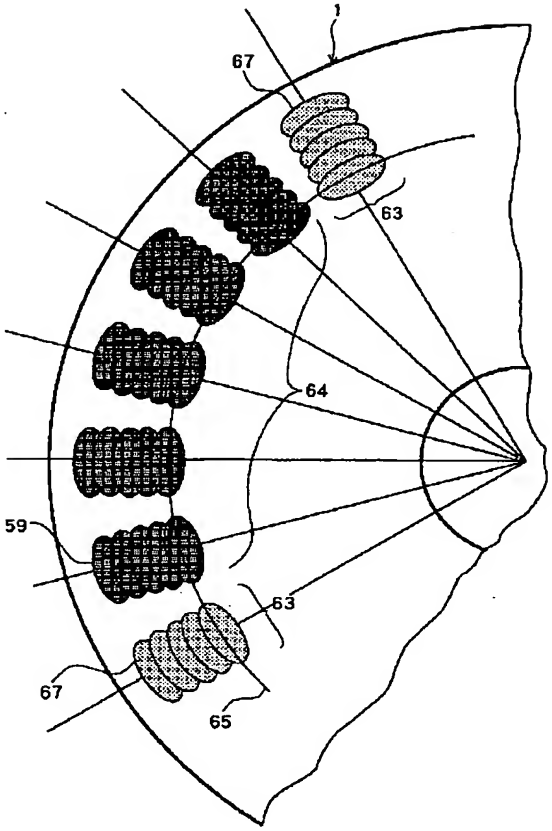
(a)



(b)



[Drawing 15]



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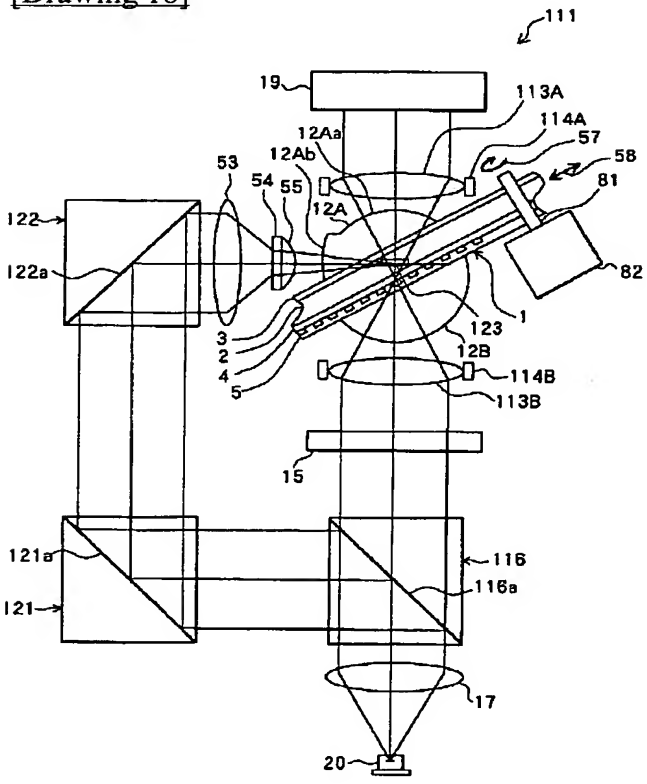

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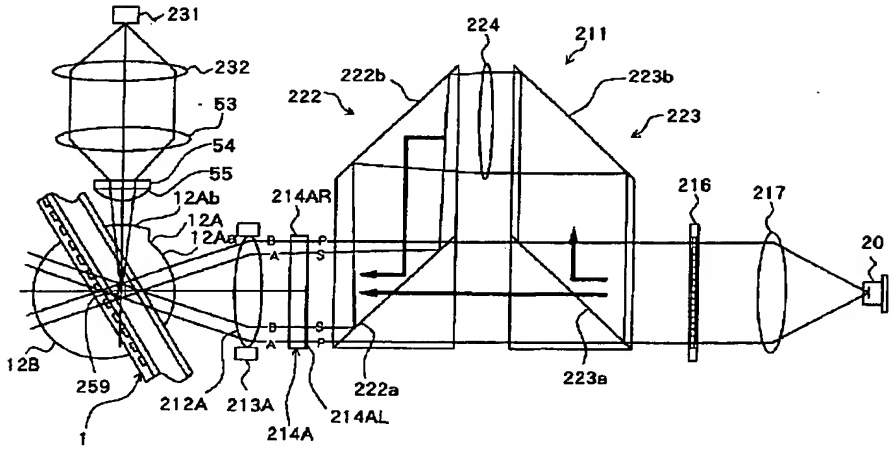

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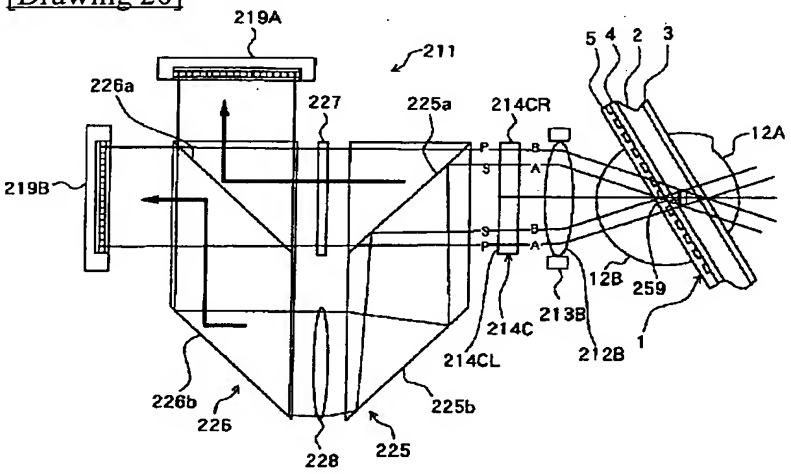
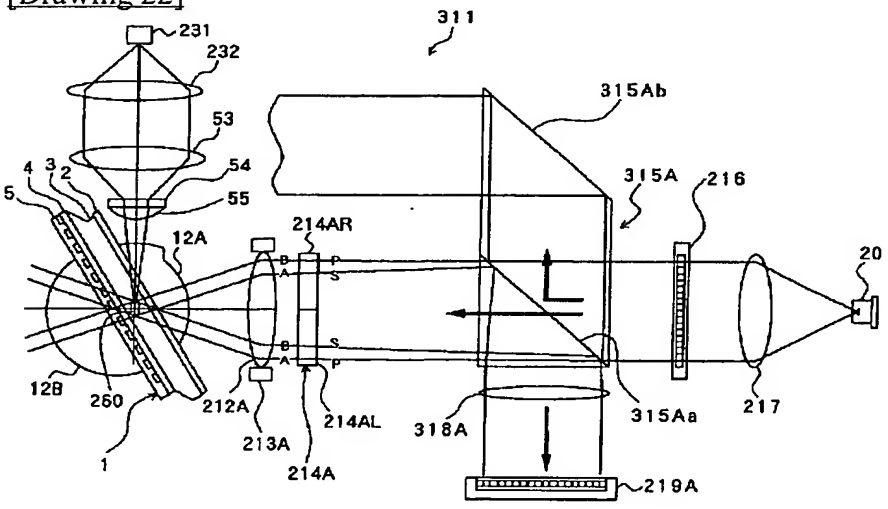
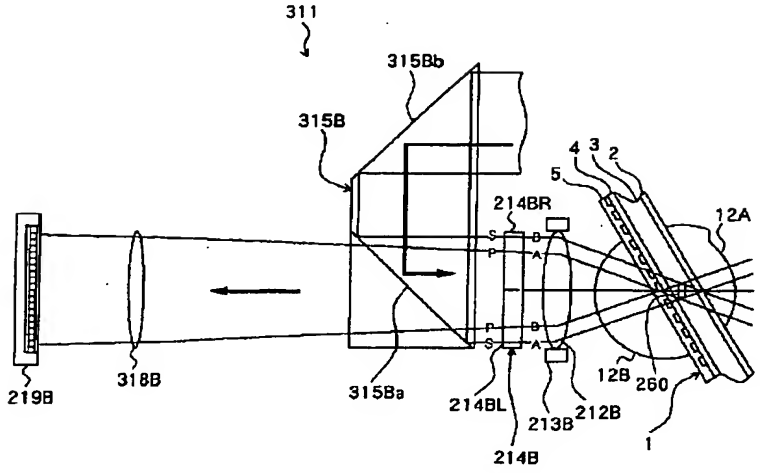


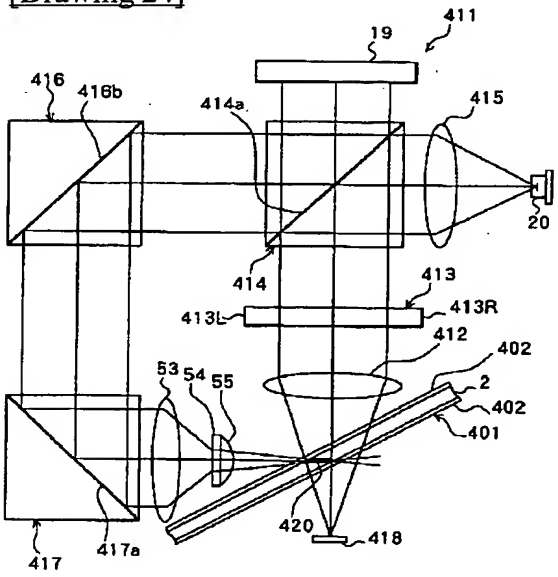
[Drawing 22]



[Drawing 23]



[Drawing 24]



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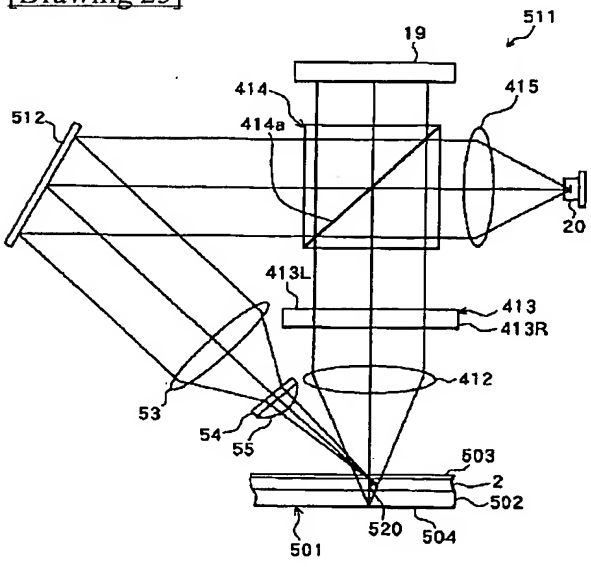
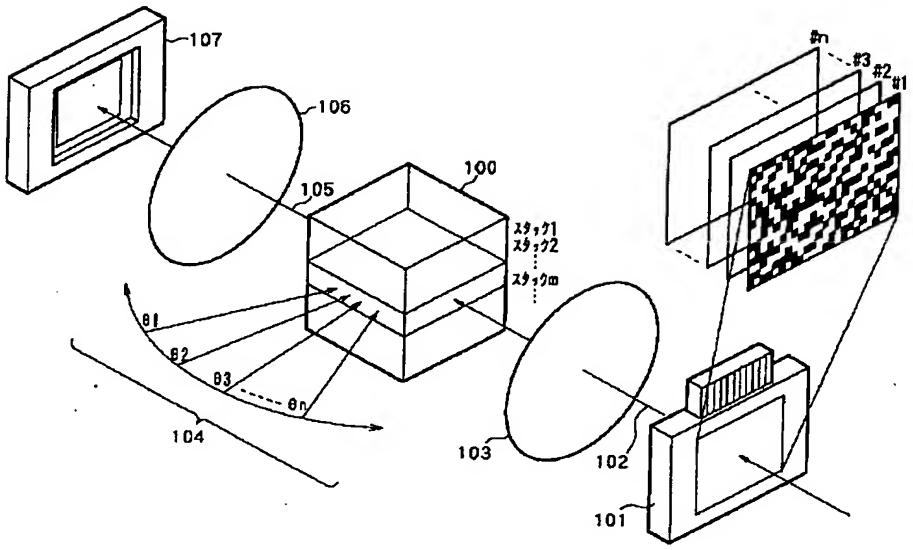


[Drawing 26]



[Translation done.]